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# BODY MEASUREMENTS OF AMERICAN BOYS AND GIRLS

for Garment  
and Pattern  
Construction

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in cooperation with the Works Progress Administration

MISCELLANEOUS PUBLICATION NO. 366

# Body Measurements of American Boys and Girls for Garment and Pattern Construction

A Comprehensive Report of Measuring Procedures and Statistical  
Analysis of Data on 147,000 American Children

by RUTH O'BRIEN, *chief*

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and ELEANOR P. HUNT, *associate anthropometrist*

TEXTILES AND CLOTHING DIVISION

BUREAU OF HOME ECONOMICS



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Division of Home Economics, Texas Technological College, Lubbock, Tex.  
Department of Home Economics, Texas State College for Women, Denton, Tex.  
School of Home Economics, Utah State College, Logan, Utah.  
Department of Home Economics, University of Utah, Salt Lake City, Utah.

## Foreword

This study of the body measurements of 147,088 boys and girls, was conducted as a Works Progress Administration project in 16 States and the District of Columbia from February 8, 1937, to June 30, 1939. In a Nation-wide endeavor of this kind, the success of which is wholly dependent upon the cooperation of large groups of widely scattered organizations and individuals, it is impossible to name and to thank adequately all who contributed. However, the Bureau of Home Economics wishes to take this opportunity to express its deep appreciation for the whole-hearted cooperation given to this undertaking by the thousands of persons who participated.

Federal and State Works Progress Administration officials assisted generously in planning the project and in selecting qualified personnel. During the peak period of the study, over 800 relief workers were employed, through the cooperation of State and Federal W. P. A. offices. Milton C. Forster, coordinator of research, Statistical and Survey Projects of the Federal W. P. A., and his assistant W. R. F. Stier were especially helpful throughout the entire study. Relief agencies assisted in classifying the sample as to economic status. The National Youth Administration supplied workers in some of the States.

A sectional committee of the American Standards Association, sponsored by the American Home Economics Association, and under the chairmanship of Harriet R. Howe, assisted in selecting the measurements, the methods followed in taking them, and the statistical procedures used in analyzing the results. Thus it was assured that the study would be practical for the industry, and would provide a useful basis for standard garment and pattern sizes. The cooperation of this committee and of P. G. Agnew, secretary of the American Standards Association, was invaluable. The membership of the committee at that time was as follows:

American Association of University Women: Ruth Ayres.	National Association of Home Demonstration Agents: Adelaide Barts; Grace Smith, alternate.
American Home Economics Association: Ardenia Chapman, Alice L. Edwards, Harriet R. Howe, Inez LaBossier, Lillian Locke.	National League of Women Voters: Ruth Ayres.
American Retail Federation: David R. Craig.	National Retail Dry Goods Association: Charlotte W. Abbott, Helen Alexander, Helen P. Knappe, alternate; W. H. Bingham, B. J. Antolini, alternate; A. C. Icke; Katherine MacGregor; Dorothy Ashworth; Julia McHugh; Donal G. Murphy.
J. R. Bauman Normal Model Form, Inc.: S. Weinstein.	Simplicity Pattern Co.: Caroline Hutchins.
Bauman's Original Designs, Inc.: J. R. Bauman; C. W. Meyer, alternate.	Underwear Institute: Roy A. Cheney, Francis E. Simmons, E. E. West, alternate.
The Boys' Apparel Buyers' Association: Theodore Kahan.	United Infants' and Children's Wear Association: Max Zuckerman, Jacob J. Lubell.
The Butterick Company, Inc.: M. Lonie; C. M. Payne, alternate.	United States Department of Agriculture, Bureau of Home Economics: Ruth O'Brien, Meyer A. Girshick, alternate.
Cavanaugh Form Co., Inc.: P. C. Cavanaugh; Raymond Darney, alternate.	United States Department of Labor, Bureau of Labor Statistics, Retail Price Division: Ethel D. Hoover.
General Federation of Women's Clubs: Olive Lister Smith.	United States Department of Agriculture, Consumer Standards Project: S. P. Kaidanovsky.
Industrial Council of Cloak, Suit, and Skirt Manufacturers, Inc.: Julius Katz, Hugo Rudinger.	The Vogue Pattern Service and the Hollywood Pattern Co.: Norman R. Oliver.
International Association of Garment Manufacturers: A. F. Allison.	Member-at-large: Harry Simons.
Limited Price Variety Stores Association, Inc.: F. W. Kuhner; W. R. Waters.	
McCall Corporation: Mayer Rohr.	

Appreciation is also expressed to the administrators of the cooperating colleges, universities, and other institutions that participated in the project. The staff members of these agencies who worked directly on the study are listed below. They arranged local training schools for measurers, obtained permission to measure the children, and assisted in supervising the measuring units.

Henrietta M. Thompson, head, Department of Clothing and Textiles, University of Alabama.	Mary E. Freeman, head, Department of Home Economics, Chicago Teachers College, assisted by Frances L. Swain, director of household arts, Chicago Board of Education.
Harold E. Jones, director, Institute of Child Welfare, University of California.	C. H. McCloy, research professor of anthropometry and physical education, State University of Iowa, assisted by Rosalie V. Rathbone, head, Department of Textiles and Clothing, Iowa State College.
Inga M. K. Allison, dean, Division of Home Economics, Colorado State College, assisted by Katherine A. Miles, associate professor, Division of Home Economics, Colorado State College, and by Anna W. Williams, head, Department of Home Economics, University of Colorado.	Alpha Latzke, head, Department of Clothing and Textiles, Kansas State College.

Julia P. Grant, supervisor of Home Economics, Detroit Public Schools.

Ethel L. Phelps, associate professor of textiles and clothing, and Richard E. Scammon, distinguished service professor in the Graduate School, University of Minnesota.

Charlotte M. Ullrich, director of household arts, Cincinnati Public Schools.

Pauline Beery Mack, director of the Ellen H. Richards Institute, Pennsylvania State College.

Ida Adelaide Anders, head, department of textiles and clothing, School of Home Economics, University of Tennessee.

Jessie Whitacre, chief, Division of Rural Home Research, Texas Agricultural Experiment Station, assisted by Margaret W. Weeks, dean, Division of Home Economics, Texas Technological College and Erceel S. Eppright, director, Department of Home Economics, Texas State College for Women.

Sadie O. Morris, assistant professor of foods and textiles, Utah State College, assisted by Lila M. Canavan, assistant professor of home economics, Department of Home Economics, University of Utah.

Cordial thanks are extended to the many city and county superintendents, principals, teachers, and playground and club leaders who at great personal inconvenience made it possible to measure the children under their supervision. And above all, we are grateful to the 147,088 children who patiently stood still long enough to be measured.

Thanks are also due to Lennah Curtiss Zens, administrative assistant of the Bureau of Home Economics; Charles E. Snow and Everett L. Marshall, anthropometrists who assisted in training the measurers; to Albert E. Craig and Cassie F. Skilling, who assisted in the statistical analysis of the results; Marion D. Bingham, Helen J. Plakas, Abraham Frankel, and Raymond W. Winters, members of the Baltimore and Washington statistical units who supervised the statistical calculations; and to Catherine E. Hoffman, who was in charge of the measuring in the District of Columbia.

LOUISE STANLEY,  
*Chief, Bureau of Home Economics.*



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# Introduction

## Purpose of the Study

This study, financed by the Works Progress Administration and conducted as a W. P. A. project, was made in order to supply accurately taken body measurements for use in the construction of children's garments and patterns.

Unsatisfactory sizing is a source of much consumer difficulty in the selection of suitable clothing for children. For, although it is common knowledge that many children of the same age have entirely different dimensions (fig. 1), garments and patterns now are



FIGURE 1.—These three girls are 8 years old.

sized mainly on the basis of age. Moreover, different manufacturers make garments of different sizes for children of the same age. Also, due to competitive practices, few articles of clothing are large enough for children of the ages for which they are marked.

As a result of the difficulties in securing properly fitting children's clothing, retailers, especially mail-order companies, complain of huge annual losses due to

large returns. These difficulties are caused partly by the lack of uniformity in the dimensions used by different manufacturers. Partly they are due to the fact that measurements for this purpose never have been taken with scientific accuracy on a representative sample of the child population of the country. Studies of body measurements have been restricted largely to growth and anthropological researches that have not included the measurements used for garment sizes (9)<sup>1</sup>. The only published report of an American study of this kind with clothing construction definitely in view is the one made on 100,000 men during the demobilization at the end of the World War (7).

The idea has long prevailed that if a scientific study were made of the body measurements of a representative sample of children, the dimensions of a hypothetical "average" child of each age could be assembled. This together with perhaps an average chubby and an average slim child of the same age, might then solve the fitting problem. This study was initiated, therefore, not only to obtain scientifically taken measurements of a large and representative sample of children, but also to analyze the variations of these dimensions in order to determine the most satisfactory basis for sizing children's garments and patterns.

## Organization of the Project

State units were established in Alabama, California, Colorado, Illinois, Iowa, Kansas, Maryland, Michigan, Minnesota, Nebraska, Ohio, Pennsylvania, Tennessee, Texas, and Utah. A unit was also set up in the District of Columbia in which procedures were tested out before they were used nationally. In addition, this group did some measuring in nearby Virginia communities. Each State unit was headed by a State director who was a member of the staff of a cooperating university or other institution. The part-time services of the State directors were donated for the purpose of making arrangements for the children of the community to be measured and of giving general supervision to the local work. The names of the State directors are listed in the Foreword (p. III).

The Bureau of Home Economics employed a staff of anthropometrists to develop the measuring techniques and to train the measurers. In addition, the Bureau employed and gave special training in the measuring procedures to 39 women and 23 men, most of whom were college graduates with training in such fields as child study, physical education, and anthropometry. Some of these men and women also had experience as playground supervisors, teachers, and scout leaders.

These workers were sent to the cooperating States to supervise and check the measuring done by the em-

<sup>1</sup> Italic numbers in parentheses refer to Literature Cited, p. 139.

ployees of the Works Progress Administration and the National Youth Administration who served as measurers. Where needed they also acted as measurers. They assisted the State directors in arranging schedules of work for the measurers. And they were responsible both for keeping the instruments in good condition and for maintaining adequate supplies for the workers.

Most of the measuring was done by W. P. A. and N. Y. A. workers, organized in measuring squads. In general, squads consisted of two measurers, two recorders, and aides. The aides directed the children to and from the measuring rooms, removed the skin pencil marks placed on their bodies by the measurers, and assisted the children in dressing and undressing. In order not to interfere too much with the regular school program, the measurers worked in small groups. Usually not more than one or two squads were in a school or institution at the same time.

In most of the States there were about an equal number of men and women measurers—the men measuring the boys, and the women measuring the girls. Texas and California were exceptions. All the measurers in Texas, and all but one in California, were women. In California no W. P. A. measurers were employed. The Bureau representatives in that State worked as measurers. In the District of Columbia, the number of W. P. A. measurers was small; therefore the Bureau measurers in the District were assigned to measuring rather than supervisory duties.

The schedules when completed were sent to a statistical unit organized as a W. P. A. project in Baltimore, Md., under the supervision of the Bureau. There the schedules were edited, coded, then sent to Washington for machine sorting and for tabulation.

### Children Measured

The children measured were the general run of white American-born boys and girls in public and private schools, on playgrounds, in camps, and in clubs. Any child able to take part in normal school and playground activities was included.

In all, 147,088 boys and girls ranging in age from 4 to 17 years were measured. Distribution of children by State and county is shown in the following tabulation:

State and county	Number of children	State and county	Number of children
<b>Alabama:</b>		<b>California—Con.</b>	
Barbour.....	5	Tehama.....	1
Bibb.....	490	County unspecified..	197
Fayette.....	380	<b>Total.....</b>	<b>5, 532</b>
Greene.....	213		
Hale.....	313	<b>Colorado:</b>	
Houston.....	3	Adams.....	2
Jefferson.....	1, 196	Alamosa.....	4
Marengo.....	20	Arapahoe.....	4
Perry.....	1	Bent.....	1
Pickens.....	469	Boulder.....	2, 860
Sumter.....	6	Clear Creek.....	8
Tuscaloosa.....	5, 814	Costilla.....	5
Walker.....	91	Delta.....	4
Wilcox.....	6	Denver.....	166
County unspecified..	216	Eagle.....	1
<b>Total.....</b>	<b>9, 223</b>	El Paso.....	9
		Fremont.....	4
<b>California:</b>		Gilpin.....	8
Alameda.....	2, 077	Grand.....	3
Contra Costa.....	2, 611	Gunnison.....	2
Imperial.....	645	Huerfano.....	2
Monterey.....	1	Jefferson.....	7

State and county	Number of children	State and county	Number of children
<b>Colorado—Con.</b>		<b>Kansas—Con.</b>	
Kit Carson.....	2	Jackson.....	1
Lake.....	2	Jefferson.....	1
Larimer.....	2, 956	Johnson.....	10
Las Animas.....	2	Labette.....	1
Logan.....	47	Linn.....	1
Mesa.....	74	Lyon.....	4
Montrose.....	3	Marshall.....	1
Morgan.....	2	McPherson.....	56
Otero.....	6	Meade.....	1
Park.....	1	Mitchell.....	2
Phillips.....	2	Montgomery.....	2
Prowers.....	1	Morris.....	1
Pueblo.....	6	Nemaha.....	1
Rio Grande.....	2	Neosho.....	1
Routt.....	2	Ottawa.....	350
Saguache.....	23	Reno.....	3
Sedgwick.....	1	Republic.....	1
Weld.....	2, 540	Rice.....	2
Yuma.....	1	Riley.....	429
County unspecified..	495	Rooks.....	1
<b>Total.....</b>	<b>9, 258</b>	Saline.....	901
		Sedgwick.....	3, 630
<b>District of Columbia.....</b>	<b>5, 226</b>	Seward.....	1
		Shawnee.....	770
<b>Illinois:</b>		Stafford.....	3
Cook.....	13, 575	Sumner.....	5
Lake.....	24	Trego.....	1
Peoria.....	2	Washington.....	2
Shelby.....	1	Wyandotte.....	1, 055
County unspecified..	995	County unspecified..	1, 251
<b>Total.....</b>	<b>14, 597</b>	<b>Total.....</b>	<b>9, 425</b>
		<b>Maryland:</b>	
<b>Iowa:</b>		Allegany.....	2
Bremer.....	58	Anne Arundel.....	21
Cerro Gordo.....	7	Baltimore.....	3
Crawford.....	1	Baltimore (city).....	2, 945
Dallas.....	1	Caroline.....	5
Des Moines.....	1	Cecil.....	66
Dubuque.....	90	Charles.....	2
Hamilton.....	1	Dorchester.....	1
Iowa.....	2	Frederick.....	10
Jefferson.....	1	Garrett.....	4
Johnson.....	16	Harford.....	5
Kossuth.....	2	Howard.....	7
Lee.....	4	Kent.....	6
Mahaska.....	4	Montgomery.....	1, 623
Marshall.....	1	Prince Georges.....	1, 709
Mills.....	3	Queen Annes.....	112
Montgomery.....	2	St. Marys.....	5
Muscatine.....	33	Somerset.....	3
Polk.....	7, 921	Talbot.....	170
Pottawattamie.....	44	Washington.....	2
Scott.....	173	Worcester.....	3
Tama.....	168	<b>Total.....</b>	<b>6, 704</b>
Taylor.....	1		
Wapello.....	14	<b>Michigan:</b>	
Webster.....	1	Barry.....	1
County unspecified..	95	Genesee.....	2
<b>Total.....</b>	<b>8, 644</b>	Huron.....	1
		Ingham.....	3
<b>Kansas:</b>		Jackson.....	1
Bourbon.....	1	Kent.....	1
Brown.....	1	Livingston.....	2
Butler.....	1	Macomb.....	11
Chautauqua.....	1	Marquette.....	1
Comanche.....	1	Menominee.....	1
Cowley.....	5	Oakland.....	14
Crawford.....	1	Saginaw.....	1
Dickinson.....	425	Saint Clair.....	3
Doniphan.....	1	Tuscola.....	1
Edwards.....	1	Washtenaw.....	1
Ellis.....	1	Wayne.....	10, 519
Ford.....	2	County unspecified..	1, 647
Franklin.....	1	<b>Total.....</b>	<b>12, 210</b>
Geary.....	413		
Greenwood.....	80	<b>Minnesota:</b>	
Harvey.....	1	Douglas.....	1
Haskell.....	1	Hennepin.....	9, 206

State and county	Number of children	State and county	Number of children	State and county	Number of children	State and county	Number of children
<b>Minnesota—Con.</b>		<b>Tennessee—Con.</b>		<b>Virginia—Con.</b>		<b>Virginia—Con.</b>	
Ramsey	3, 596	Davidson	1	Henrico	9	Page	1
County unspecified	432	Greene	2	Isle of Wight	2	Princess Anne	4
<b>Total</b>	<b>13, 235</b>	Hamblen	12	King and Queen	19	Southampton	2
<b>Nebraska:</b>		Hamilton	1	Montgomery	4	Warren	3
Cuming	1	Jefferson	1	New Kent	23	Westmoreland	4
Douglas	7, 247	Knox	6, 084	Norfolk	3	County unspecified	455
Lancaster	1	Loudon	2	Northumberland	1	<b>Total</b>	<b>876</b>
Phelps	1	McMinn	2	Orange	38		
County unspecified	95	Monroe	1				
<b>Total</b>	<b>7, 345</b>	Morgan	9				
<b>Ohio:</b>		Roane	2				
Brown	4	Wayne	4				
Butler	13	County unspecified	109				
Clark	2	<b>Total</b>	<b>6, 257</b>				
Clermont	9	<b>Texas:</b>					
Clinton	1	Bexar	2, 253				
Fairfield	1	Dallas	290				
Franklin	4	Denton	697				
Greene	2	Ector	1				
Hamilton	12, 094	Harris	2, 244				
Hancock	13	Lubbock	2, 450				
Harrison	4	County unspecified	24				
Jefferson	2	<b>Total</b>	<b>7, 959</b>				
Lawrence	1	<b>Utah:</b>					
Lucas	1	Beaver	1				
Miami	1	Box Elder	4				
Montgomery	15	Cache	2, 392				
Shelby	2	Carbon	6				
Trumbull	2	Davis	6				
Union	1	Duchesne	3				
Warren	1	Iron	3				
County unspecified	354	Juab	6				
<b>Total</b>	<b>12, 527</b>	Millard	3				
<b>Pennsylvania:</b>		Salt Lake	6, 550				
Allegheny	122	Sanpete	6				
Blair	2, 364	Sevier	8				
Bucks	6	Summit	14				
Cambria	79	Tooele	5				
Centre	221	Uintah	2				
Chester	71	Utah	40				
Clearfield	1	Wasatch	1				
Delaware	5	Weber	5				
Huntingdon	10	County unspecified	352				
Monroe	1	<b>Total</b>	<b>9, 407</b>				
Northumberland	18	<b>Virginia:</b>					
Philadelphia	5, 241	Alexandria (city)	56				
Somerset	17	Arlington	191				
County unspecified	507	Chesterfield	8				
<b>Total</b>	<b>8, 663</b>	Culpeper	1				
<b>Tennessee:</b>		Dickenson	2				
Anderson	2	Dinwiddie	1				
Blount	23	Elizabeth City	1				
Campbell	2	Fairfax	45				
		Frederick	3				

Although every effort was made to obtain a group representative of all white children of school age in the United States, ideal sampling methods could not always be followed. The selection of States and of communities within a State in which measuring was done depended upon more than statistical considerations. It was limited for example by the willingness of local authorities to have the children measured, upon the existence of large numbers of children in localities not so scattered as to unduly increase the cost of measuring, and upon the availability of qualified W. P. A. workers. Children aged 4 to 14 were measured in 16 States and the District of Columbia. In addition to these, children 15 to 17 were measured in 5 of these States, namely: Colorado, Illinois, Michigan, Ohio, and Utah. A few children under 4 and over 17 were measured in some States, but they were not included in the analysis of the measurements. Table 1 gives the total sample, classified according to age, sex, and parentage—whether native, or foreign or mixed.

TABLE 1.—Total sample of 147,088 children classified by age,<sup>1</sup> sex, and parentage

Age (years)	Native parentage		Foreign or mixed parentage	
	Boys	Girls	Boys	Girls
4	853	978	101	164
5	2, 226	2, 625	306	380
6	4, 069	4, 467	607	603
7	4, 908	5, 162	751	712
8	5, 440	5, 424	1, 001	865
9	5, 659	5, 617	1, 065	1, 019
10	5, 926	5, 627	1, 211	1, 128
11	5, 818	5, 394	1, 171	1, 140
12	5, 899	5, 180	1, 230	1, 021
13	5, 622	4, 713	1, 283	980
14	4, 722	3, 759	1, 424	948
15	3, 362	2, 930	1, 505	1, 235
16	2, 844	2, 441	1, 215	997
17	2, 019	1, 512	848	625
Under 4 and over 17	2, 286	1, 772	1, 373	926
<b>Total</b>	<b>61, 653</b>	<b>57, 601</b>	<b>15, 091</b>	<b>12, 743</b>

<sup>1</sup> An age group is defined in this study as a 12-month interval beginning with the last birthday of a child and ending with his next birthday. Thus all children at least 60 months and less than 72 months of age were considered to be 5 years old.

# Measuring Procedures

## Equipment and Supplies

All measuring instruments were purchased<sup>2</sup> by the Bureau of Home Economics and after calibration were shipped to the units together with the necessary forms and supplies. The Bureau also furnished the measuring costume, which consisted of shorts for the boys and the younger girls, and shorts and nonbinding bandeaux for the older girls (pl. 1, *A*). The shorts were cut high on the thighs. Each garment was laundered after use by one child.

Instruments and small supplies sufficient for one measuring squad were arranged in kits, which could be carried conveniently (pl. 1, *D*). These were as follows:

Item	Number	Item	Number
Anthropometer.....	2	Pocket knife.....	1
Protractor head.....	1	Neck chains.....	2
Sliding caliper.....	1	Steel guide rod.....	1
2-meter linen tape.....	1	Carpenter's chalk.....	1
2-meter steel tape.....	1	Spool of twine.....	1
Skin pencils.....	4	Manual of measurements.....	1

In addition, each squad was supplied by the Bureau with one portable leveling platform, one portable weighing scales, and rubbing alcohol, cold cream, and cotton for removing the skin pencil marks placed on the children as landmarks for the measuring. Local arrangements were made for a receptacle in which to dispose of the cotton swabs, for chairs of the proper height for taking the measurement of the extreme bend (p. 16), and for the chairs and tables needed for the recorders, aides, and children.

The anthropometer consisted of two wooden meter sticks that could be joined by a brass dowel and a wooden key to prevent twisting. The upper stick had one horizontal arm fixed at the top and a sliding horizontal arm with a reversible and tapered brass point piece (pl. 1, *D*). The horizontal arms were braced with brass corner triangles. The sliding arm was provided with a lower brass collar, which helped to hold it perpendicular to the long shaft and was used to indicate readings on the long shaft. The two metric scales on opposite sides of the long shaft had zero points at opposite ends of the shaft so that either end of the anthropometer could be used conveniently to measure heights from the floor.

The protractor head was a craftsman's tool used in this study to measure the slope of the shoulder line (pl. 1, *B*). The frame in which the protractor was set was equipped with a wooden guide piece, which rested on the specified body landmarks described on page 9. The revolving protractor carried a spirit level, which, when set in a horizontal plane, permitted the observer to read from the protractor scale the acute angle (in degrees) formed by the shoulder line with the horizontal plane.

The sliding caliper was also a craftsman's tool used for locating the under arm midpoint of the armseye (pl. 1, *C*). The tapes were all provided with spring releases for rewinding. When children would not stand quietly while the steel tape was used, linen tapes were substituted.

The skin pencils were the wax type commonly used for physical examinations.

The neck chains were fine-gage and small-link. They were long enough to pass around the neck, cross over at the back, and hang free down the sides of the neck toward the front.

The steel guide rod was a knitting needle 2 millimeters in diameter and about 30 centimeters long. It was used as a straightedge when indicating the direction of certain lines to be marked on the body with the skin pencil.

The leveling platforms were 2 by 3 feet. They were made of ply board with battens and were provided with four set screws and two spirit levels. They were used in taking measurements of height from the floor when the floors in the measuring rooms were not level (pl. 3, *C*). The portable scales were of the type shown in plate 1, *A*. They were provided with set screws with which the calibration could be set at zero before each subject was weighed.

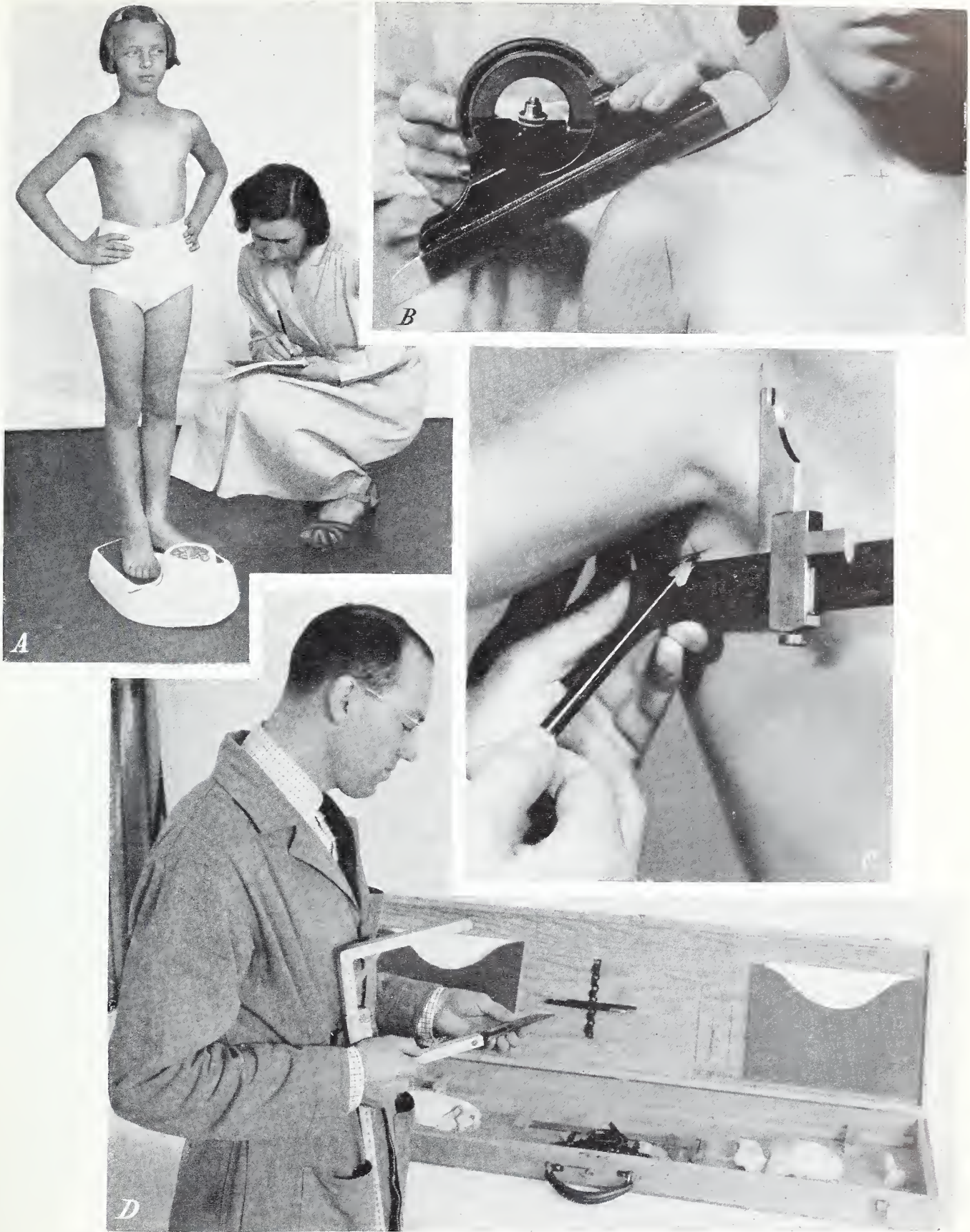
## Selection of Measurements

Many specialists cooperated in the selection of the measurements included in the study. The clothing section<sup>3</sup> of the Division of Textiles and Clothing of the Bureau compiled the original list based upon experience in pattern and clothing construction and upon a study of the literature in this field. This list was revised in accordance with the recommendations of a conference of manufacturers of children's clothing and patterns, distributors, home economists, and anthropometrists held in New York City on March 3, 1937. At this conference the proposed measurements and the suggested measuring procedures were demonstrated and discussed. Subsequently, further recommendations were obtained at a conference in Washington, D. C., of the State directors of the project, and by a questionnaire circulated to manufacturers and distributors located in various communities throughout the United States.

The final list of measurements was then compiled, taking into consideration all the recommendations received and the practicability of obtaining the desired measurements. Clothing measurements that did not lend themselves readily to definite anatomical description were omitted, because they could not be taken accurately by a large corps of measurers. Measurements for hats, shoes, and gloves had to be omitted,

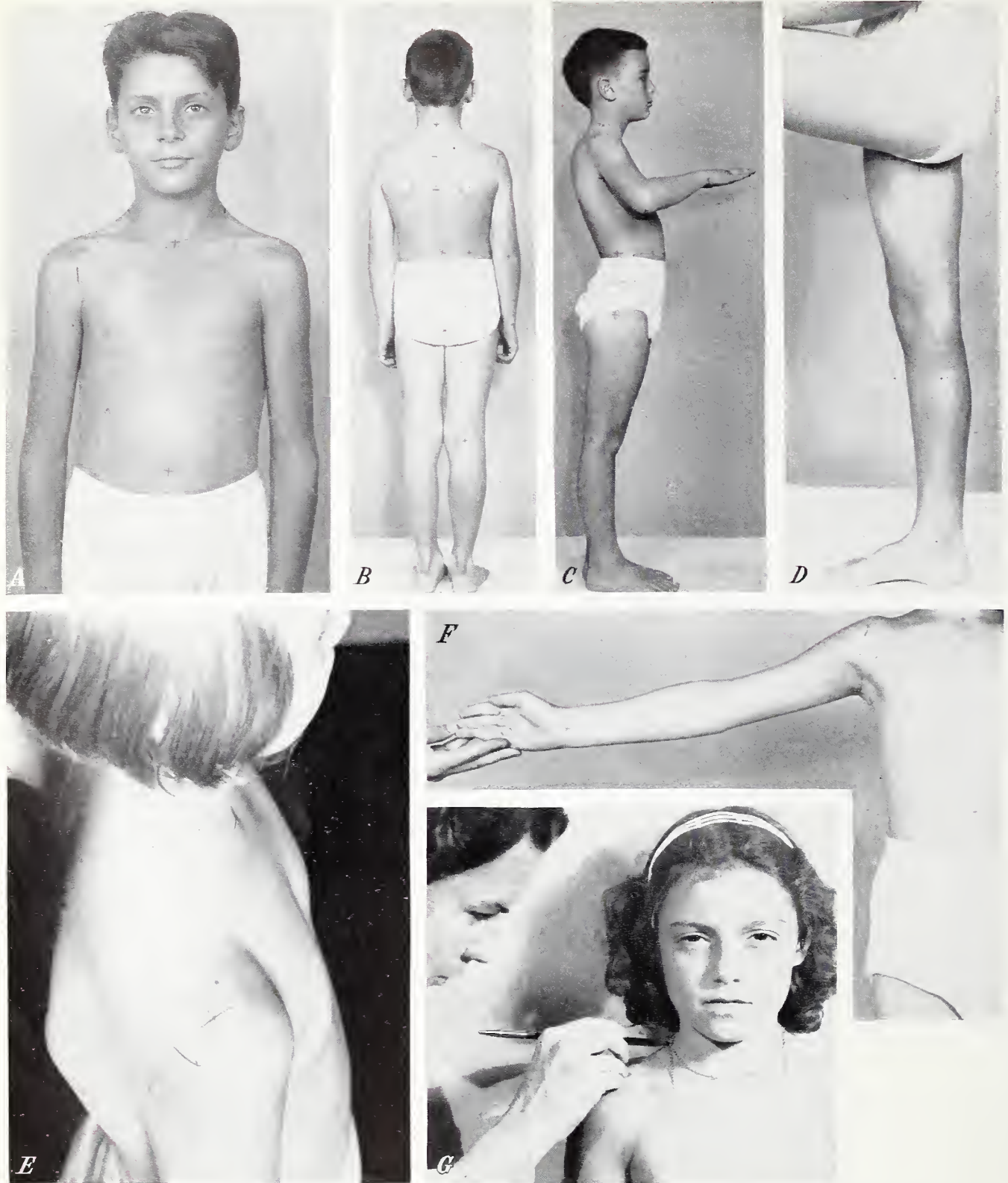
<sup>2</sup> Some of the standard sets were purchased by the Texas Technological College and were sent to the Bureau of Home Economics for calibration.

<sup>3</sup> Clarice L. Scott, assistant home economics specialist, and Margaret Smith junior home economics specialist, of the Bureau of Home Economics gave generous assistance with this part of the study.



**MEASURING EQUIPMENT.**

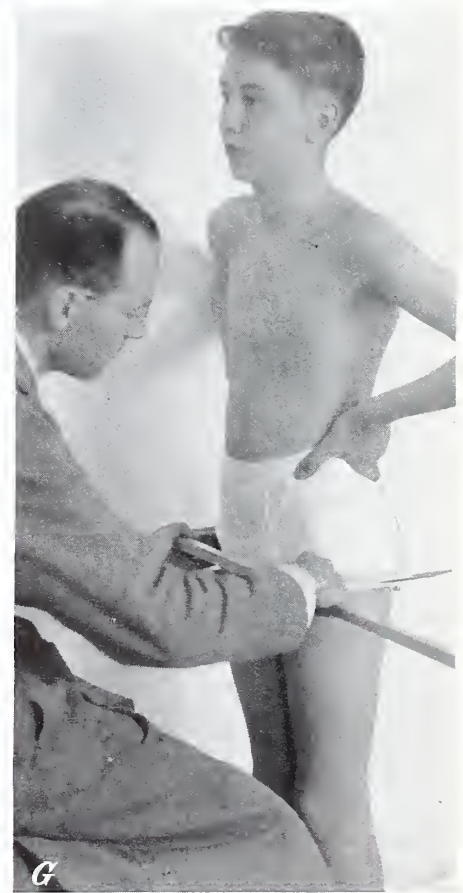
*A*, Costume worn by children; portable scales used for weighing; *B*, measuring shoulder slope; *C*, sliding caliper used to bisect the axillary fossa of the underarm; *D*, kit of instruments and small supplies provided for each measuring squad.



BODY LANDMARKS USED IN TAKING MEASUREMENTS.

*A*, Landmarks on anterior of trunk; *B*, landmarks on posterior of trunk and right leg; *C*, landmarks at neck base, hip level, waist level, underarm, elbow, and wrist; *D*, landmark at crotch level corresponding to the position of the intersection of trouser seams in the crotch; tibiale is marked at knee and sphyrion at the ankle; *E*, landmarks used in locating the position of the sleeve seam; *F*, landmarks at waist level, neck base, armhole, and midanterior wrist; the underarm midpoint and corresponding point on the trunk are also shown; *G*, use of neck chain to indicate the curve of the neck base.





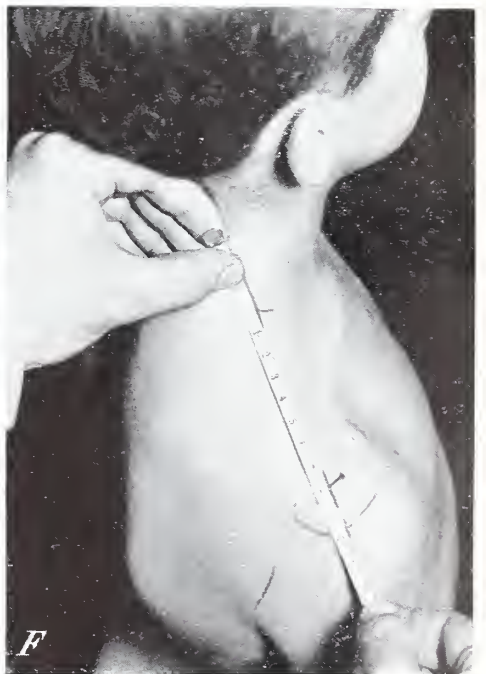
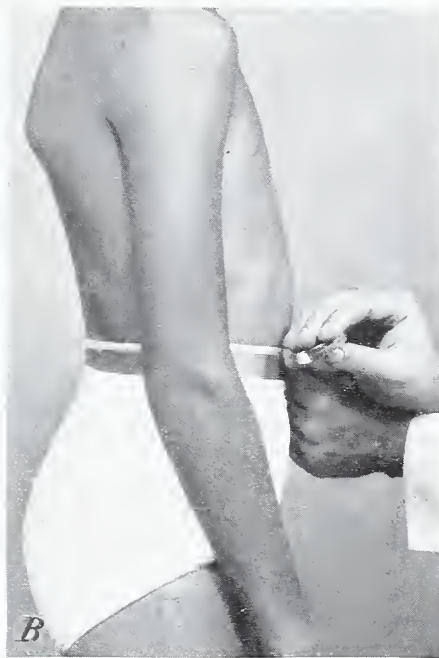
MEASUREMENTS TAKEN WITH THE ANTHROPOMETER.

Measuring: *A*, Height of waist; *B*, height of hips; *C*, height of cervicale; *D*, height of tibiae; *E*, stature; *F*, height of crotch; *G*, bitrochanteric width.



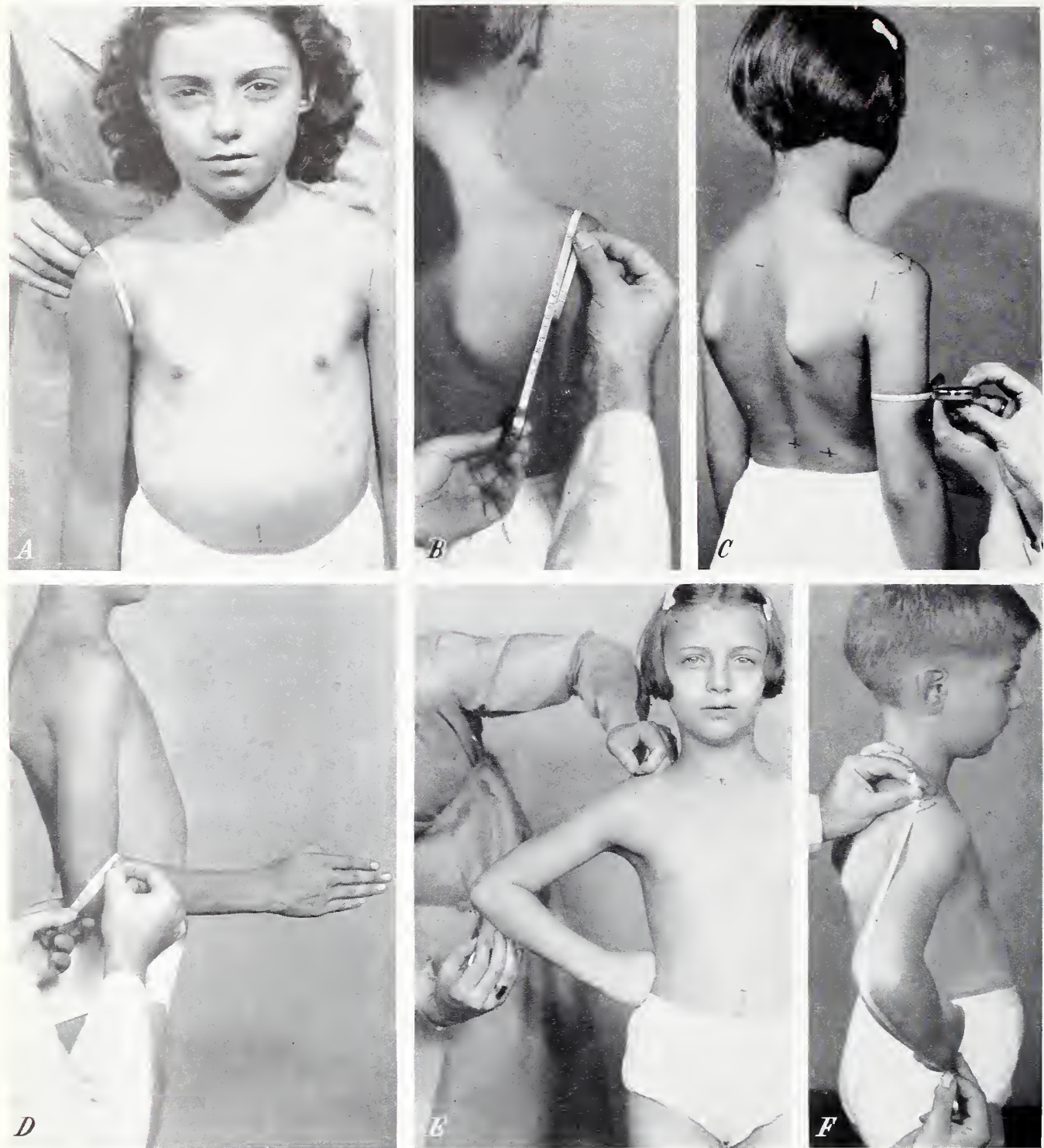
MEASUREMENTS TAKEN WITH THE TAPE.

Measuring: A, Width of chest, anterior; B, length of waist, anterior; C, length of waist, posterior; D, width of chest, posterior; E, girth of chest at armscye; F, depth of scye.



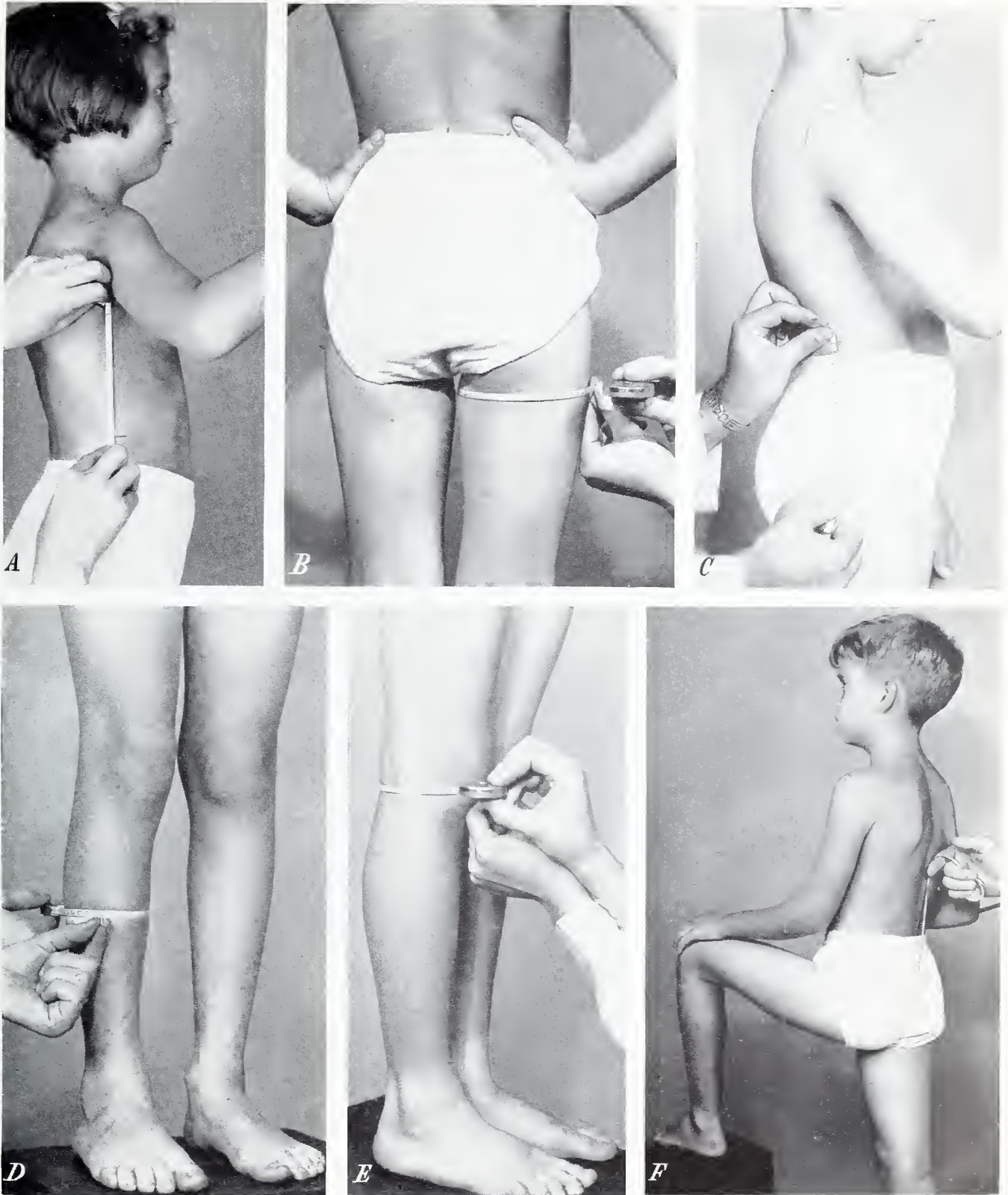
**MEASUREMENTS TAKEN WITH THE TAPE.**

Measuring: *A*, Anterior arc of chest; *B*, girth of waist; *C*, girth of neck base; *D*, posterior arc of hips; *E*, girth of hips; *F*, shoulder length.



MEASUREMENTS TAKEN WITH THE TAPE.

Measuring: *A*, Girth of armscye, front view; *B*, girth of armscye, back view; *C*, girth of upper arm; *D*, girth of elbow; *E*, upper segment of posterior surface of right arm; *F*, total length of posterior surface of the arm.

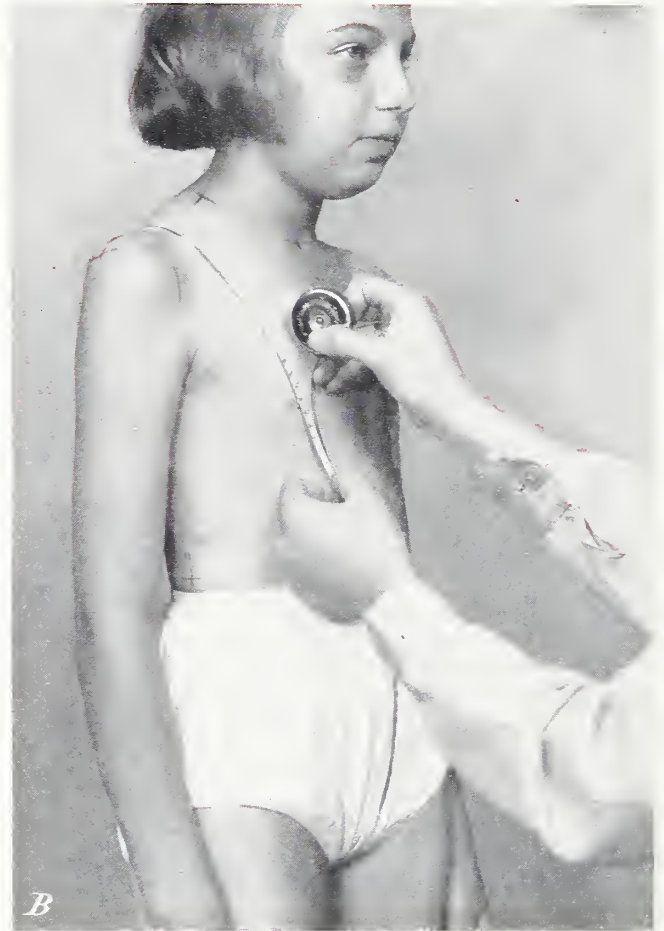


**MEASUREMENTS TAKEN WITH THE TAPE.**

Measuring: *A*, Trunk line; *B*, maximum girth of thigh; *C*, length of waist to hip; *D*, maximum calf girth; *E*, girth of knee at tibiale; *F*, total length of crotch.



*A*



*B*

**MEASUREMENTS TAKEN WITH THE TAPE.**

Measuring: *A*, Extreme bend; *B*, vertical trunk girth.

because the time involved in taking these in addition to the other measurements unduly fatigued the children. School authorities were unwilling to permit the measurement of large groups more than once.

The measurements taken on every child are listed below in the order in which they appear on the schedule (pp. 17-18). With the exceptions noted, all measurements were metric, and were recorded in centimeters to the nearest millimeter.

- |                              |                                 |
|------------------------------|---------------------------------|
| 1. Waist height.             | 20. Hip girth.                  |
| 2. Hip height.               | 21. Neck-base girth.            |
| 3. Weight (pounds).          | 22. Shoulder length.            |
| 4. Stature.                  | 23. Armscye girth.              |
| 5. Cervicale height.         | 24. Upper arm girth.            |
| 6. Tibiale height.           | 25. Elbow girth.                |
| 7. Crotch height.            | 26. Upper posterior arm length. |
| 8. Bitrochanteric diameter.  | 27. Total posterior arm length. |
| 9. Shoulder slope (degrees). | 28. Trunk line.                 |
| 10. Anterior chest width.    | 29. Waist to hips.              |
| 11. Anterior waist length.   | 30. Thigh girth.                |
| 12. Posterior chest width.   | 31. Maximum calf girth.         |
| 13. Posterior waist length.  | 32. Knee girth.                 |
| 14. Chest girth at armscye.  | 33. Total crotch length.        |
| 15. Scye depth.              | 34. Anterior crotch length.     |
| 16. Posterior hip arc.       | 35. Extreme bend.               |
| 17. Maximum chest girth.     | 36. Vertical trunk girth.       |
| 18. Anterior chest arc.      |                                 |
| 19. Waist girth.             |                                 |

### Training Schools for Measurers

Training schools for supervisory measurers and for measurers were arranged in the cooperating States. Only individuals completing the work of a training school satisfactorily were permitted to take measurements. Twenty-two such training schools were conducted, at which 266 persons were trained. Approximately 50 measurers who had completed training returned to later schools for additional instruction and checking.

A manual of measurements described in detail the procedures to follow in placing the body landmarks and in taking the measurements. This manual was used as a textbook in the training schools and as a handbook throughout the duration of the project.

A model (generally a boy) for each trainee was present throughout the period of each training school so that landmarks and measurements could be discussed and practiced with reference to living subjects. The models were so assigned that each trainee worked with all the models before the close of the school. Children were selected who varied in skeleton, musculature, and behavior. The training schools thus provided the trainees with a sample of the measuring and child management problems characteristic of the work to be met later in the field. Management of the children, use and care of the instruments and schedules, and relations with the local authorities were given full consideration in all of the training schools.

Variations in instruction were kept at a minimum by limiting the number of training school instructors. The anthropometrist in charge and her assistant conducted all of the 16 training schools held during the first year of the project and 2 of the 6 schools held later. Another assistant anthropometrist, conducted 2 schools, and 2 supervisory measurers conducted 1 each. The 3 latter instructors were experienced measurers on the project. They were given special training and their work checked carefully before they were entrusted with this additional responsibility.

At the end of each of the 22 schools, either the anthropometrist in charge or her assistant personally checked the procedures of each trainee, and determined whether or not he or she qualified as a satisfactory measurer.

Before the opening of the schools, the two Bureau anthropometrists had developed personal measuring technique, such that they could duplicate the measurements of each other on one subject within the tolerances agreed upon for the various measurements. These tolerances provided a standard for the difference between two observers. This standard was used in the training schools to illustrate the problem of personal error and to define the limits of acceptable differences between two observers measuring the same subject.

The training schools provided a record from which personal error could be estimated for each of the measurers at the close of the period of training. Upon completion of the training, each person who had qualified as a measurer prepared duplicate measurements on each of the models. These also had been measured by the instructors. Thus a check on the ability of the measurer was obtained before work in the field was begun. This initial record of differences among the measurers was supplemented by duplicate measurements taken from time to time in the field (p. 22).

All training schools were conducted similarly throughout the country. The recommended program was described in a handbook for the instructors and their assistants. It was followed as closely as local conditions permitted. The length of the school was usually 12 workdays. The first 4 days were devoted to demonstration and discussion of the body landmarks and the procedures of measurement. During the 4 or 5 days following, the trainees duplicated complete sets of measurements of the children, usually boys, who acted as models. The remaining days of the school were spent in discussing the results of these duplicated measurements, and in giving each trainee specific instructions for perfecting his technique. Women measurers practiced with girl models, either in the training school after their duplicates were completed, or early in the field period.

### Placing of Landmarks

In many cases the landmarks were located with reference to skeletal structure (figs. 2, 3, 4). In a few instances, bisections of a given region were utilized, as at the armscye, waist, hip, and medial thigh at crotch level. For the purpose of description, the landmarks are grouped here according to whether they are located on the neck, trunk, or an upper or lower extremity. In the routine of measuring, the order of placement was that which permitted the greatest dispatch in preparing the subject. Following are the instructions issued to the measurers and taught in the training schools.

### Landmarks of the Neck

*The neck base.*—Three landmarks determine the position of the neck base. They are the cervicale and the upper borders of the medial extremities of the right and left clavicles (pl. 2, A, B). The closed curve of the neck base is indicated by a fine-gage, flexible-link chain looped about the neck so that it passes over the cervicale and touches the two anterior landmarks. The placement of the chain is shown in plate 2, G.

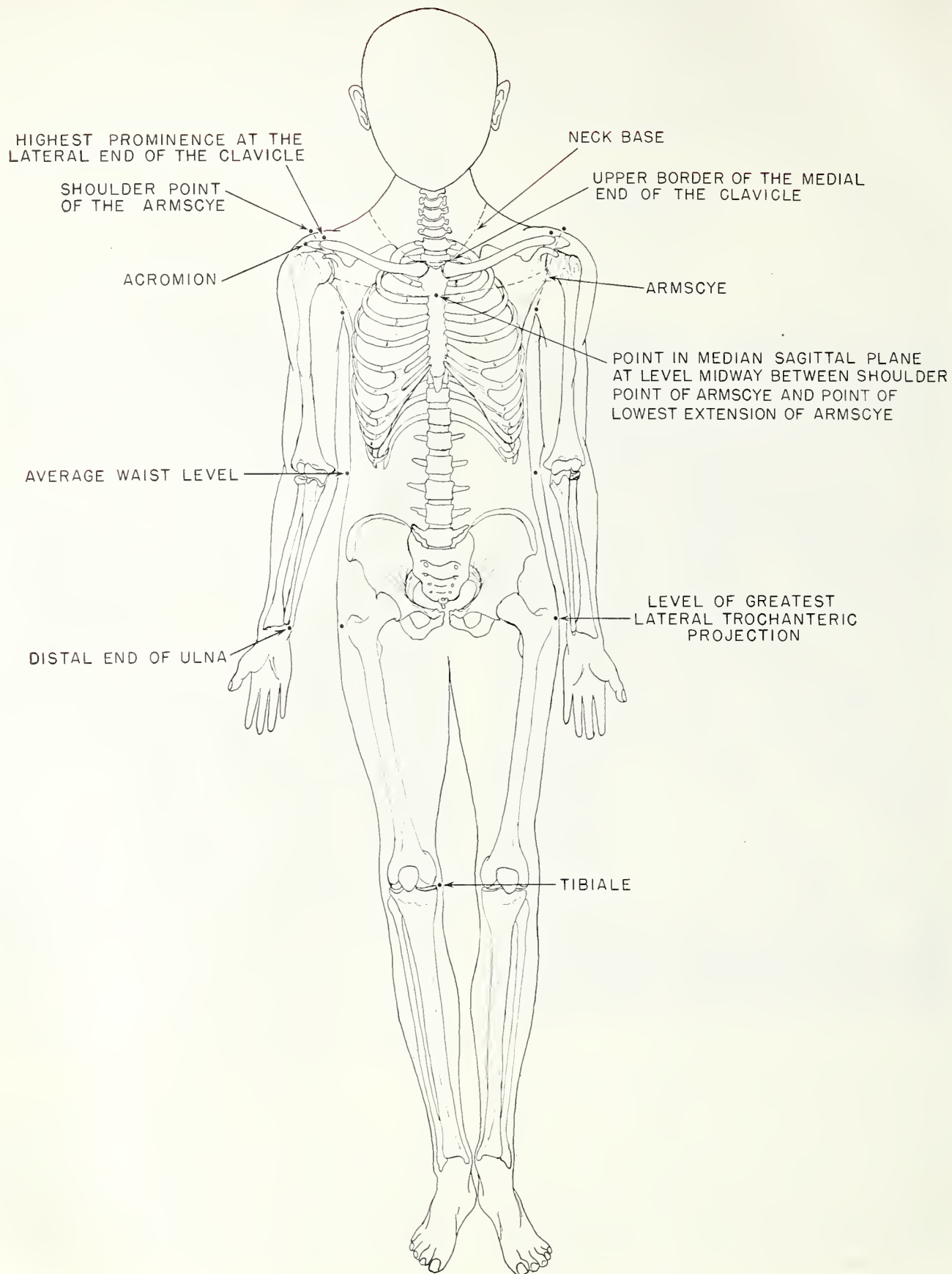


FIGURE 2.—Body landmarks used in taking measurements. Front view.



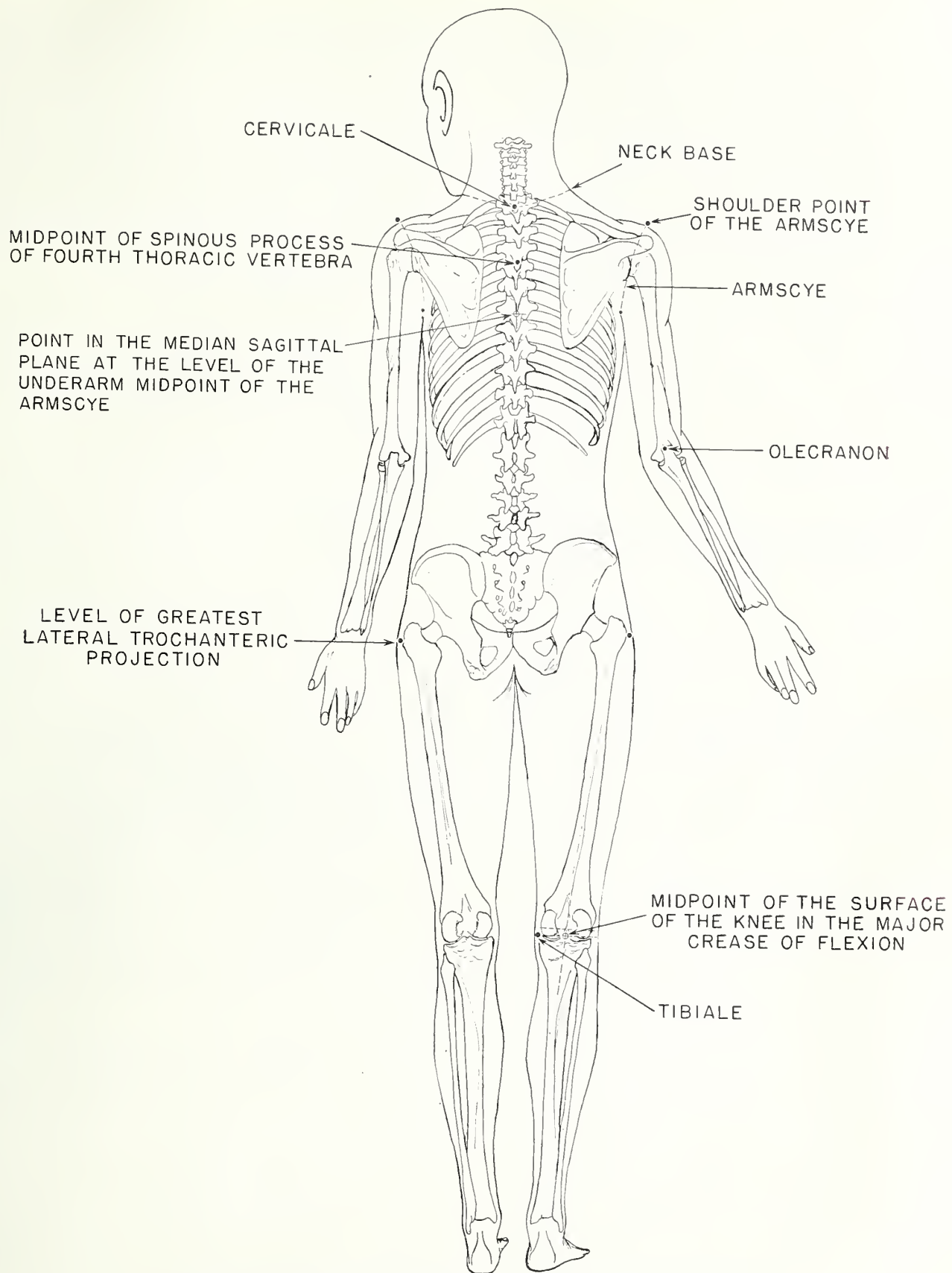


FIGURE 3.—Body landmarks used in taking measurements. Back view.

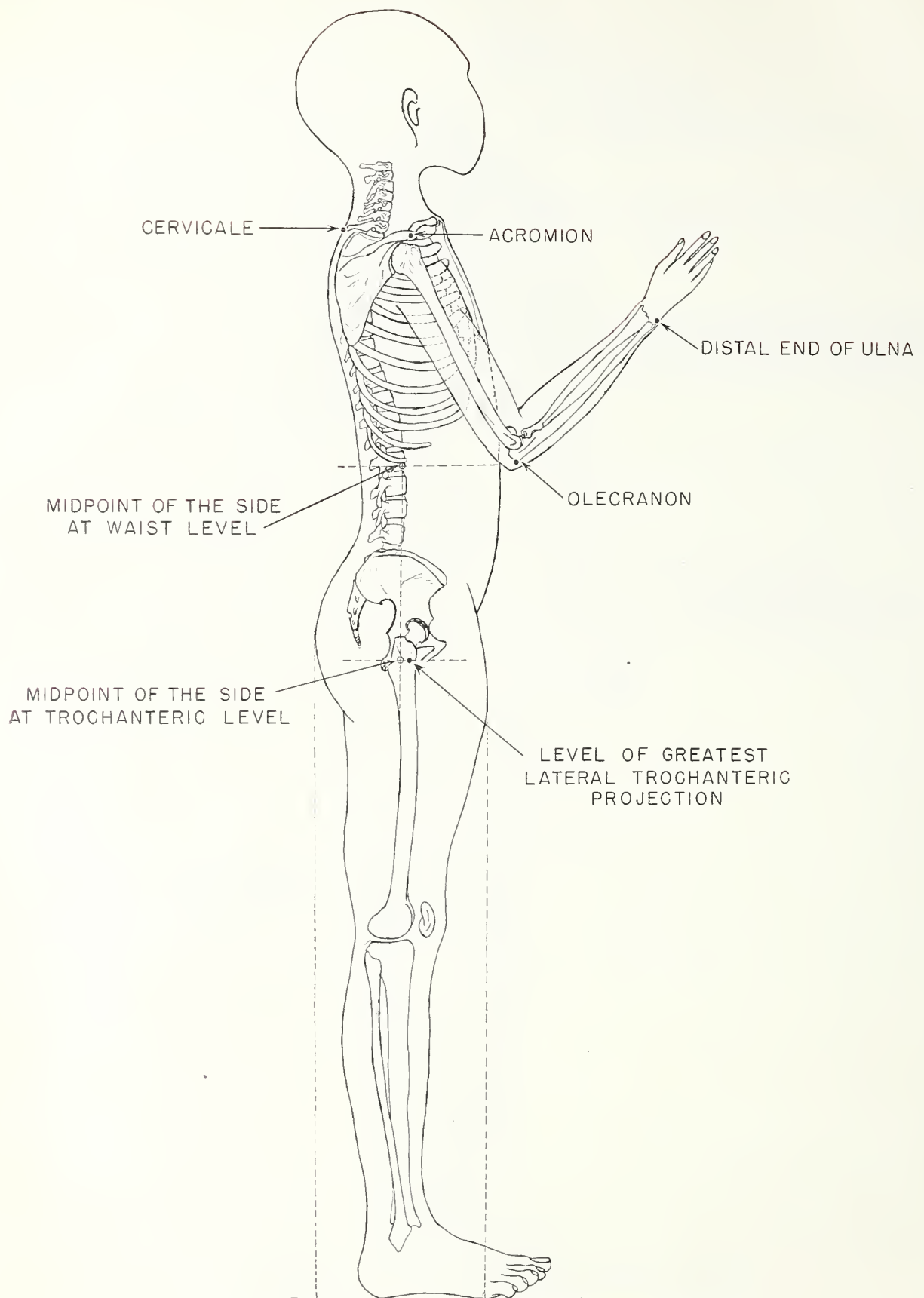


FIGURE 4.—Body landmarks used in taking measurements. Side view.

While the chain is poised, its position is marked in the center front and over the trapezius muscle on the right and left sides. The short vertical line intersecting the neck base at the center front is drawn in the median sagittal plane. Such crosses give well-defined zero or reading points. The cross at cervicale is placed centrally on the prominence of the spinous process of the seventh cervical vertebra. This prominence is usually the most superior when the head is dropped forward. The prominence is palpated more readily when the head is forward, but the landmark is placed when the skin is in the normal position with the head erect.

### Landmarks of the Trunk

*The armscye.*—The position of the circular seam of the set-in sleeve is marked by four landmarks, and the closed curve thus indicated is called the armscye. The armscye is marked on the right and left arms. The determining landmarks on each arm are the shoulder point, underarm midpoint, and the armscye anterior and posterior. The procedure of locating the landmarks is identical for the right and left side and is described here for the right side only.

The shoulder point is situated midway between the acromion and the most superior point of the lateral extremity of the clavicle. The most superior point of the lateral extremity of the clavicle is marked as shown in plate 2, *E*.

The acromion is defined in this study as a point on the lateral margin of the acromial process anterior to the angle of the process and posterior to the center of the shoulder as judged by sight. In practice the acromion is placed midway between the limits described.

The first step is to outline the lateral border of the acromial process (pl. 2, *E*). Points are then placed on the outline at the angle of the process and at the sighted center of the shoulder. A line intersecting the outline of the process is placed midway between the two limiting points. The intersection is termed the acromion. This position corresponds very closely to the acromion as defined by Martin (*S*) at the most lateral point of the margin of the acromial process. The use of the midpoint between two easily located limits reduces considerably the uncertainties inherent in exploring the process for the most lateral point.

When the acromion and the most superior point of the lateral extremity point of the clavicle have been determined, the shoulder point of the armscye is readily located midway between these two limiting points.

The armscye anterior and posterior are traced with the aid of a chalked string. A small-gage, white string well covered with ordinary mason's chalk and about 18 inches in length is used for this purpose. The center of the string is placed under the arm when the arm is raised about 30 degrees from the trunk. The ends of the string are raised and crossed up over the shoulder point, thus indicating the direction of the armscye anteriorly and posteriorly as well as under the arm. The armscye anterior and posterior are marked as shown in plate 2, *A* and *B*. Short, thin, sloping lines follow the chalked path of the armscye. They are placed centrally with respect to the distance between the shoulder and underarm so that they will serve as zero and reading points at the level of the fourth

thoracic vertebra posteriorly, and the level of the mid-armscye region anteriorly.

The underarm midpoint is located with reference to the natural folds in the axillary fossa and the total width of the shoulder. The height of the midpoint in the axillary fossa is decided on the basis of the size and position of the axillary folds. The observer sits in front of the subject and observes the formation of the folds on the right and left sides as the arms are raised to about 45 degrees and gradually lowered to meet the trunk. Usually the folds of one axillary fossa are more clearly defined than those of the other side. The level of the midpoint is set with respect to the more clearly defined folds, and a corresponding level is marked off in the fossa of the opposite side. A short thin slightly curved line on the trunk marks the level. The vertical line indicating the bisection of the total width of shoulder is drawn through the line indicating the underarmscye level. The intersection of the two lines is the underarm midpoint of the trunk. The underarm midpoint of the trunk can be identified in plate 2, *C*, and is clearly seen in plate 1, *C*. In plate 2, *F*, is also illustrated a corresponding underarm midpoint on the arm. The midpoint on the arm is placed so that it will fall upon the midpoint of the trunk when the arm is lowered to the side. It is necessary to determine the position of the midpoint on the arm by trial placements and readjustment after observing the correspondence of the arm and trunk points when the arm is alternately raised and lowered.

Plate 1, *C*, shows the manner in which the bisection of the shoulder is carried out. The small sliding caliper is used. The upper margin of the shaft of the caliper is held against the trunk at the level of the armscye. The shaft is horizontal, and the jaws are in a vertical position. The jaws touch the shoulder anteriorly and posteriorly without constriction. The subject's arm is raised laterally to an angle of approximately 90 degrees with as little elevation of the shoulder as possible. With the caliper in this position the midpoint of the total width is marked with the skin pencil.

The criteria of placement of the underarm midpoints, on the arm as well as on the trunk, are nonanatomical and are based upon the conventions of clothing construction. The measurer is called upon to decide, in view of the axillary folds, to what height under the arm a blouse can extend without forming an uncomfortable surplus of fabric in the fossa when the arm is lowered. The highest level considered feasible is the one chosen. By placing the midpoints of the arm and trunk in correspondence when the arm is lowered, the points are separated by a distance varying with the individual and including the deepest region of the fossa. The measurements thus do not provide for fabric in this deep region, and any shortage of the garment when the arm is raised is compensated by rise of the sleeve over the arm or of the blouse from the waist.

*The shoulder line.*—This line intersects the neck base and the armscye at the shoulder and corresponds to the customary shoulder seam of a garment. It is located on the right shoulder with reference to the trapezius muscle and the acromion. By palpation at the neck base, the borders of the upper fibers of the trapezius, which pass forward and downward to become inserted in the lateral extremity of the clavicle, and acromial process are identified. The intersection of the shoulder line with the neck base is placed at the anterior border

of the trapezius. The lateral end of the shoulder line is directed by the acromion although the intersection of the shoulder line is actually with the armscye (pl. 2, *E*). A small steel guide-rod is used to aid the observer in orienting the neck base and armscye intersections, with respect to the trapezius border and the acromion.

*Average waist level.*—For the purposes of this study, the waist level is taken at the lowest rib margin palpated in the midaxillary line. This waist level also corresponds very closely to the natural or sighted waist which is observable when the lateral profiles are slightly concave. A natural waist in the latter sense is not frequent among younger children, and this definition is accordingly not useful throughout the age groups of this study. On the other hand, the waist level based on the lowest rib margin palpable in the midaxillary line can be used equally well in all age groups. This waist level also provides for maximum depth of the garment from waist to crotch level. In this respect it is preferable to a waist placed at the crest of the ilium, a level which is readily determined but results in shallow crotch measurements, and a waist of minimum height.

To locate the waist, the observer sits in front of the subject and palpates the right and left sides simultaneously, using the index fingers to press against the sides in the midaxillary region. The hands are held with the palms directed toward the floor. The fingers are extended and together. The thumb side of the middle joint of the index finger is used for palpating in the midaxillary position. The direction of the pressure is medial. When the lower margin of the lowest rib palpated in the midaxillary position is felt on the dorsal surface of the index finger, the level of the midline of the index finger is taken as waist level. Without displacing the skin, the level is marked with a point in the midaxillary position, on the right and left sides.

The waist levels of the right and left sides frequently differ, and the average height from the floor of the two sides is considered waist level. The anthropometer is used to lay off the average height at center front, center back, and at the right side of the back (pl. 2, *A*, *B*, *C*). If the difference in height between the right and left sides exceeds 4 millimeters the points first placed on the sides are "corrected" to correspond with the average height of waist.

The finished landmarks of the waist are five in number. Small crosses composed of two short, straight, thin lines at right angles, similar to those at the neck base and cervicale are used. The horizontal branches indicate average height of waist. In the center front and back the vertical intersecting lines are in the median sagittal plane. The intersection at the right side of the back is located by bisecting the distance measured with the tape between center back and center side. The intersection in the region of the midaxillary position is a projection of a bisection at hip level of a maximum panel defined by the regions of the buttocks and thigh. The panel is illustrated in figure 4 and discussed more fully under the landmarks of the hip.

*Level for the measurement of width of chest.*—Short, straight, thin lines are used anteriorly and posteriorly to indicate the level at which the width of chest between the armscyes is measured. Posteriorly the landmark is placed centrally on the prominence of the spinous process of the fourth thoracic vertebra. The landmark on the anterior of the chest is placed at a level that is

midway between that of the shoulder point of the armscye and the level of the lowest visible point of the armscye. The latter point in field practice is indicated by placing a pencil under the arm so that the blunt end is visible at the juncture of the arm and trunk. These landmarks appear in plate 2, *A* and *B*.

*Level for the measurement of maximum chest girth.*—To guide the measurer in placing his tape at the level at which the girth of chest appears to be greatest, a landmark is placed at this level after consideration of the contour of the chest. The region of the chest is viewed from one side and the anterior and posterior profiles are considered. A preliminary landmark is placed at the level at which the girth appears to be the greatest. This landmark is placed anteriorly or posteriorly according to convenience or the profile which controls the judgment. Similarly, preliminary landmarks are placed when the subject is viewed from the opposite side. The average height of the two preliminary landmarks is taken as the level of maximum chest girth.

The final landmark may be placed in the center back (pl. 2 *B*). Or, if the anterior profile has been used to set preliminary landmarks, it is more convenient to place the final landmark anteriorly. On boys younger than 11 years of age these landmarks are not used, and the measurement of maximum girth of chest is omitted. The landmarks and measurements are omitted also on girls younger than 10 years. Among the girls in the older age groups the level corresponds to maximum girth over the mammary glands or, in clothing terminology, the bust measurement (pl. 4, *E*).

### Landmarks of the Right Upper Extremity

*Olecranon.*—The length of the upper segment of the arm is measured from the armscye-shoulder line intersection to the olecranon or the elbow. The precise reading point for this measurement is marked by an intersection at the most lateral point of the olecranon when the closed fist is rested against the waist with the dorsal side of the hand facing anteriorly.

*Distal extremity of the ulna.*—The total length of the arm is measured from the armscye-shoulder line intersection over the olecranon to the distal extremity of the ulna at the wrist. To locate the distal limit of the ulna, the flat of the thumbnail of the observer is pushed upward against the extremity of the ulna. On the side corresponding to the little finger the styloid process is palpated. Its distal limit is indicated by a short line drawn perpendicular to the long axis of the ulna. An intersecting line is placed at right angles to the limit.

*Midanterior wrist point.*—This is the reading point for the measurement of length of arm anterior. Its position is illustrated in plate 2, *F*. The landmark is placed in a median position on the anterior or the volar surface of the wrist. Its position distalward is identical to that of the landmark of the ulna. It is merely a sighted projection of that distal position onto the volar surface.

### Landmarks of the Lower Extremity

*Average hip level.*—The level of the hip is defined as the level of the most laterally projecting point of the upper extremity of the femur in the region of the trochanter major. The level is determined independently for the right and left sides, which usually differ. The

average of the two levels is taken as the hip level. The preliminary landmarks are corrected to correspond with the average if the difference between the two sides exceeds 4 millimeters.

The extended index and middle fingers of the observer's right hand are used to palpate the region of the trochanter. Palpation is carried out while the observer squats with eyes approximately at the level of the trochanter. The direction of palpation is proximalward; that is, from below upward. On well-developed, muscular individuals, and when excessive fat pads are present, the palpation must be somewhat prolonged and determined. To assist the observer in finding the level, the subject is often asked to bend slightly forward as though picking up an object from the floor, or the subject rotates the femur by turning the toes laterally and pivoting the heel. These are aids in identifying the low rounded subcutaneous bony prominence in the region of the great trochanter. The midpoint of the region is marked with a preliminary point to indicate hip level. The average hip level is marked with a short horizontal line.

The vertical intersection is placed in the midline of a hypothetical vertical "panel" (fig. 4). The posterior limit of the panel is an imaginary vertical line tangent to the most posterior point of the profile curve of the buttocks. The anterior limit of the panel is an imaginary vertical line tangent to the most anterior point of the profile of the thigh.

The panel is a device, arising from the uses of conventionalized clothing construction, to bring the side seams of a garment in a central position with respect to the lateral region of the hip. It is set up for bisection by placing the steel guide rod and skin pencil tangent to the buttocks and thigh profiles, respectively at the most projected points of the two profile curves. The observer squats with eyes at hip level while the bisection is marked and checked.

Under the description of the average waist level it was pointed out that the intersecting vertical line of the landmark at the center side of the waist is an extension of the vertical intersection at hip level. After the vertical intersection at hip level has been satisfactorily placed, the steel guide rod held vertically is used as a rule to extend the vertical line at the hip to the waist level.

*Crotch center.*—This landmark (pl. 2, *D*) corresponds to the point of intersection of the medial seams of a trouser leg with crotch seams of the conventional trouser type of garment. The subject rests his left foot on a chair while the landmark is placed. The observer squats at the side of the subject with his eyes at the level of the gluteal fold, and directly in front of the medial surface of the thigh. The subject's right foot is directed straight forward. The median line of the medial surface is sighted and marked by a thin vertical line extending downward from the level of the perineum. If the lower borders of the measuring suit obscure the region, the subject is asked to draw them up by lifting the suit by the waist band.

*Knee center posterior.*—The height of this landmark is determined with reference to the natural creases of the skin at the back of the knee. By flexing the subject's knee, the creases are clearly expressed. The direction of the most pronounced crease is outlined. A vertical intersection is drawn in the median line of the posterior region of the knee. The region is thought

of as an irregular and more or less quadrilateral area extending over the condyles of the femur and the upper extremities of the tibia and fibula. The landmark is shown in plate 2, *B*.

*Tibiale, right.*—The tibiale is the highest point on the proximal and medial margin of the tibia when the subject stands erect. The precise location is difficult to ascertain if the medial fat pads at the knee are well developed. In this study the medial "cleft" of articulation between the condyles of the femur and the upper extremity of the tibia has been used as a guide to the position of the medial and uppermost margin of the tibia. The cleft is palpated by grasping the knee firmly while it is alternately flexed and extended and moving the index finger or thumb in the region of the cleft with pressure, until the margins of the condyles and tibia are identified. The tibiale is marked by a dot (pl. 2, *D*) at the level in the cleft which corresponds to the highest point of the palpated margin of the tibia. In practice, the midlevel of the palpated cleft gives a close approximation of the tibiale.

## Taking the Measurements

1. *Height of waist* (pl. 3, *A*).—This measurement is the average height of the preliminary landmarks of the waist in the midaxillary line at the lowest rib margin palpable on the right and left sides. It is recorded when the preliminary landmarks are measured preparatory to placement of the five landmarks of the average waist level described under landmarks of the trunk (p. 10).

*Instruments.*—Anthropometer. The leveling platform is used if the floor of the workroom is not level.

*Position of subject.*—The subject stands erect, feet together, facing the observer. His weight is evenly distributed. He is cautioned against shifting his weight from one foot to the other, or from toes to heel. His arms hang loosely at the sides and are placed somewhat backward.

*Position of observer.*—The observer sits in front of the subject. Or, if the height of the waist of the subject equals or exceeds one meter, it is more convenient for the observer to stand.

2. *Height of hips* (pl. 3, *B*).—The average height of the preliminary landmarks placed on the right and left sides in the region of the trochanter is recorded as the height of hips.

*Instruments.*—Anthropometer. The leveling platform is used if the floor of the workroom is not level.

*Position of subject.*—The subject stands facing the observer with hands on hips, feet together, weight evenly distributed.

*Position of observer.*—The observer ordinarily finds it convenient to sit or squat in front of the subject.

3. *Weight* (pl. 1, *A*):

*Instrument.*—Portable scales.

*Position of subject.*—The subject is asked to stand quietly on the center of the platform, hands on hips.

*Procedure.*—The dial indicator is adjusted at zero before the subject steps on the scales. The subject is instructed not to shift his weight while the reading is made.

4. *Stature* (pl. 3, *E*):

*Instruments.*—Anthropometer and leveling platform. A perpendicular wallboard is used when a suitable wall

free of baseboard and paneling is not available in the workroom.

Position of subject.—The subject stands on the leveling platform, heels together against the wall. The shoulders and buttocks just touch the wall. The eyes are directed forward, and the head is erect. The palms of the hands lie on the thighs.

Position of observer.—The observer stands at the subject's right side.

Procedure.—The anthropometer is held and balanced in a vertical position in the right hand. The left hand palpates the vertex of the head. The right hand slides the moving arm of the anthropometer down using sufficient pressure to bring the brass point piece of the anthropometer to the level of the vertex. The texture of the hair is taken into consideration when exploring the vertex.

5. *Height of cervicale* (pl. 3, C):

Landmark.—Cervicale.

Instruments.—Anthropometer. The leveling platform is used if the floor of the workroom is not level.

Position of subject.—The subject stands with heels together, far enough away from the wall toward the outer end of the leveling platform that the anthropometer can be placed back of him. The eyes are directed forward and the head is erect. The palms of the hands lie on the thighs.

Position of observer.—The observer stands back of the subject and to his left side.

Procedure.—The anthropometer is held vertically in the right hand. The straight edge of the brass point piece is directed toward the floor. The point is lowered to cervicale. The measurement is taken quickly before the child alters his position.

6. *Height of tibiale* (pl. 3, D):

Landmark.—Tibiale.

Instruments.—Upper section of the anthropometer. The leveling platform is used when the floor of the workroom is not level.

Position of subject.—The subject places his left foot on a chair which raises the foot to about the level of the midregion of the patella. The subject's weight is evenly distributed. So far as possible, the main axis of the right leg is perpendicular to the floor. The right foot is directed straight forward.

Position of observer.—The observer squats at the subject's left side with eyes at knee level.

Procedure.—The upper section of the anthropometer is inverted, so that it stands on the fixed arm. The straightedge of the brass point piece is directed toward the floor. The point is raised to the level of tibiale. The reading is taken at the upper margin of the brass collar of the movable horizontal arm.

7. *Height of crotch* (pl. 3, F):

Landmark.—Crotch level. This level is indicated by the crotch of the standard measuring garment when pulled snugly against the body.

Instruments.—Upper section of the anthropometer. The leveling platform is used if the floor of the workroom is not level.

Position of subject.—The same as for measurement no. 6. Before the left foot is raised to the chair, the subject is asked to pull up the measuring suit by the waist band in order to bring the garment in snug contact with the body. The principal transverse axis of the pelvis is approximately horizontal to the floor.

Position of observer.—The observer squats at the center back of the subject with eyes at the level of the gluteal fold.

Procedure.—The anthropometer rests on the fixed arm. The brass point piece is raised in the crotch until its straightedge is at the level of the base of the left buttock. The latter level is indicated by placing a pencil under the left buttock, tangent to the profile at its lowest point and parallel to the floor. The straightedge of the brass point piece is brought to rest on the pencil at this level of the left buttock. Caution is exercised in order not to tip the pencil from its horizontal position, nor jab the right thigh, nor exert more than moderate pressure on the under surface of the left buttock.

8. *Bitrochanteric diameter* (pl. 3, G):

Landmarks.—Average hip level, right and left sides.

Instrument.—Upper section of the anthropometer.

Position of subject.—The subject stands as for measurement No. 4, except that he is away from the wall with hands on hips. The weight is distributed equally on both feet.

Position of observer.—It is usually convenient for the observer to sit in front of the subject.

Procedure.—The straightedge of the brass point piece faces the fixed arm of the anthropometer. The shaft and arms of the anthropometer lie in a plane parallel to the floor. The midpoints of the inner surfaces of the arms are placed on the landmarks. The anthropometer is closed without pressure on the skin. The reading is made at the inner margin of the brass collar of the movable arm.

9. *Slope of shoulder* (pl. 1, B):

Landmarks.—Shoulder line-neck base intersection, and shoulder line-armseye intersection.

Instrument.—Protractor.

Position of subject.—The subject stands in the position for measurement No. 5 except that the arms are relaxed and the hands do not clasp the thighs.

Position of observer.—Back of the subject and to his right side.

Procedure.—The wooden blade of the protractor is rested on the intersections of the shoulder line with the neck base and with the right armseye. The subject is asked to carry the weight of the instrument on his shoulder without altering the position of the shoulder. The intersection of the shoulder line and the armseye is used as the pivotal point, and the opposite end of the wooden blade is lowered to the shoulder line-neck base intersection, where it rests lightly without depressing the skin surface. The instrument is balanced easily on the landmark, while the left hand is used to steady the instrument, and the right thumb and index fingers adjust the spirit level to a horizontal position.

If the protractor cannot be brought to rest on the shoulder line-armseye intersection due to interference of higher points, the blade is poised on the highest point but the blade's direction is that of the shoulder line.

10. *Width of chest, anterior* (pl. 4, A):

Landmarks.—Level for the measurement of width of chest anterior, and armseye anterior at the right and left arms.

Instrument.—Tape.

Position of subject. The subject's position is the same as for measurement No. 4 except away from the wall.

**Position of observer.**—The observer is in front of the subject with eyes at the level of the measurement. Sitting or squatting may be necessary when measuring the younger age groups.

**Procedure.**—The observer informs the subject that this measurement and the three following immediately are to be made while he stands in the given position. It is essential that the subject's position correspond with the standard position for stature, and that it be maintained throughout the set of four measurements. The upper border of the tape rests at the level of the anterior landmark. The armseye at the right arm is the zero point of the measurement. The reading is made at the armseye of the left arm. The upper border of the tape is horizontal. It may be necessary to elevate somewhat the zero and reading positions of the tape in order to bring the upper border of the tape into a horizontal position.

11. *Length of waist, anterior* (pl. 4, B):

**Landmarks.**—Neck base and average waist level in the median sagittal plane.

**Instrument.**—Tape.

**Position of subject.**—The same as for measurement No. 10.

**Position of observer.**—Identical to that for measurement No. 10.

**Procedure.**—The zero point of the tape rests at the neck base. The reading is made at the average waist level in the median sagittal plane. The subject is cautioned not to raise the chin when the zero point of the tape is placed at the neck base.

12. *Width of chest, posterior* (pl. 4, D):

**Landmarks.**—Level for measurement of width of chest posterior, and the armseye posterior on the right and left arms.

**Instrument.**—Tape.

**Position of subject.**—The same as for measurement No. 5.

**Position of observer.**—The observer is back of the subject and standing, sitting, or squatting so that his eyes are at the level of the measurement.

**Procedure.**—The upper border of the tape rests at the level indicated by the spinous process of the fourth thoracic vertebra. It is made to lie in a horizontal plane by elevating the zero and reading ends of the tape as needed. The measurement is taken without constriction. The zero point of the tape is placed at the left armseye, and the reading is made at the right armseye.

13. *Length of waist, posterior* (pl. 4, C):

**Landmarks.**—Cervicale, and the average waist level in the median sagittal plane.

**Instrument.**—Tape.

**Position of subject.**—The same as that described for measurement No. 5.

**Position of observer.**—The observer is back of the subject and to the left side.

**Procedure.**—The zero point of the tape is placed at cervicale. The subject is cautioned against dropping the head forward. The tape follows the contour of the back in the median sagittal plane without constriction. The reading is made at the average waist level.

14. *Girth of chest at armseye* (pl. 4, E):

**Landmarks.**—The underarm midpoints on the right and left sides.

**Instrument.**—Tape.

**Position of subject.**—The subject's position is his normal erect posture.

**Position of observer.**—The observer stands back of the subject.

**Procedure.**—The tape is placed around the trunk without constriction. The zero point is at the center back. The upper border of the tape rests under the arms at the level of the armseye of the trunk, and passes through the underarm midpoints of the right and left armseyes. When the subject's arms are raised slightly in order to place the tape in proper position in relation to the underarm midpoints, the tape is somewhat slack, anteriorly. If this precaution is observed, the tape will not constrict the chest muscles when the arms are lowered. If the subject elevates his shoulders, he is asked to relax them. When the tape has been placed so that its upper border passes through the underarm midpoints and the girth is set without constriction, the observer passes around to the side of the subject to check the relative positions of the anterior and posterior arcs of the girth. The two arcs lie in the same horizontal plane. It is frequently necessary to lower the arcs and set the tape more loosely. The reading is made at the midpoint of the breathing excursion. Before removing the tape, the level of its upper border is marked posteriorly by a dot in the median sagittal plane. In this manner the approximate level of the underarm midpoints is projected in the median sagittal plane and a reading point is provided for the measurement to follow.

15. *Depth of scye* (pl. 4, F):

**Landmarks.**—Cervicale and the level of underarm midpoint marked in the median sagittal plane.

**Instrument.**—Tape.

**Position of subject.**—Normal posture with head erect and eyes directed forward.

**Position of observer.**—The observer stands at the center back of the subject.

**Procedure.**—The zero point of the tape is placed at cervicale. The subject is cautioned not to lower his head. The reading is made at the point in the median sagittal plane that indicates the position of the upper border of the tape when the latter was placed for the measurement of girth of chest at armseye.

16. *Posterior arc of hips* (pl. 5, D):

**Landmarks.**—Average hip level at the right and left sides.

**Instrument.**—Tape.

**Position of subject.**—The subject stands erect, feet together, with weight evenly distributed and hands on hips.

**Position of observer.**—The observer squats back of the subject with eyes at hip level.

**Procedure.**—The zero point of the tape is placed at the hip level of the left side. The upper border of the tape lies in a horizontal plane. The reading is made on the right thigh at hip level. The measurement is taken without constriction.

17. *Maximum girth of chest:*

**Landmarks.**—Level of maximum chest girth, posterior and anterior.

**Instrument.**—Tape.

**Position of subject.**—The subject's position is his normal erect posture with feet together.

**Position of observer.**—The observer stands at the center front of the subject.

Procedure.—The tape is passed around the chest so that the upper border is at the level indicated for the measurement of the maximum girth. The zero point is at the center front or center back, depending upon the position of the landmark (p. 10). The anterior and posterior arcs of the girth lie in the same horizontal plane. The girth is measured without constriction of the musculature and mammary glands. The measurement is omitted on boys who are younger than 11 years of age and girls who are younger than 10 years of age. If the level of the girth of chest at armscye is the same as that indicated for the maximum girth of chest, the value of the two measurements is assumed to be the same. Then the value read for girth of chest at armscye is recorded for maximum girth of chest as well (pl. 4, *E*).

18. *Anterior arc of chest* (pl. 5, *A*):

Landmarks.—Underarm midpoints.

Instrument.—Tape.

Position of subject.—The subject's initial position is his normal erect posture with feet together. The arms are relaxed at the sides. The observer asks the subject to permit him to place the subject's arms in the desired position. This request frequently eliminates rigidity on the part of the subject when his arms are manipulated. The arms are brought into the position shown in plate 5, *A*, by rotating the humerus outward in the median transverse plane enough to permit the observer to see the underarm midpoints. The minimum movement to expose the points and yet not disturb their position can be accomplished if the shoulder is not disturbed, and if the movement at the shoulder is confined to elevation of the humerus. The arms are slightly flexed at the elbow. The hands are placed far enough from the sides to permit the observer to work between the arms and the trunk. Care is taken that the shoulders are not thrown forward giving the subject a hollow-chested appearance and reducing the value of the reading.

Position of observer.—The observer is in front of the subject with eyes at the level of the chest.

Procedure.—The zero point of the tape is placed at the right underarm midpoint. The upper border of the tape lies in the horizontal plane. The reading is made at the left underarm midpoint.

19. *Girth of waist* (pl. 5, *B*):

Landmarks.—Average waist level, anterior, posterior, and lateral landmarks.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture with feet together.

Position of observer.—The observer is in front of the subject.

Procedure.—The tape is placed around the body at waist level with the upper border of the tape passing through the landmarks at average waist level. The zero point is at the center front. The measurement is taken without constriction. The reading is made when the breathing is normal at the midpoint of the excursion.

20. *Girth of hips* (pl. 5, *E*):

Landmarks.—Average hip level, left and right sides.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture, feet together, hands on hips.

Position of observer.—The observer is at the right side of the subject. When the reading is made, the eyes are at hip level.

Procedure.—The tape is passed around the body so that the upper border passes through the landmark and the zero point is at hip level on the right side. The plane of the girth is horizontal. The measurement is taken without constriction.

21. *Girth of neck base* (pl. 5, *C*):

Landmarks.—Cervicale, and the lateral and anterior landmarks of the neck base.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture.

Position of observer.—The observer stands to the right side of the subject.

Procedure.—The tape is placed around the neck with its lower border passing through cervicale. The zero point of the tape lies just back of the neck base-shoulder line intersection. The thin edge of the tape rests on the anterior and lateral landmarks of the neck base. The observer fits the tape to the landmarks in succession, releasing each placement after the one following is completed. The tape is made to describe a smooth closed curve through the four landmarks. The measurement is taken without constriction or without undue slack.

22. *Length of shoulder* (pl. 5, *F*):

Landmarks.—The neck base-shoulder line intersection and the armscye-shoulder line intersection.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture, feet together, arms relaxed at the sides.

Position of observer.—The observer stands back of the subject and to the right side.

Procedure.—The zero point of the tape is placed at the neck base-shoulder line intersection. The anterior border of the tape is placed at the shoulder line. The reading is made at the armscye-shoulder line intersection. The subject is cautioned against lowering the shoulder and drawing the head away from the tape at the zero position.

23. *Girth of armscye, right* (pl. 6, *A* and *B*):

Landmarks.—Underarm midpoint, armscye anterior and posterior, and armscye-shoulder line intersection.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture, feet together, and arms relaxed at sides.

Position of observer.—The observer is back of the subject and to the right side.

Procedure.—The subject's arm is raised high enough to let the observer place the tape under the arm, so that the thin edge passes through the underarm midpoint, and the zero point falls just below the armscye posterior. The case end of the tape is brought up over the shoulder, and the case is allowed to drop down over the back, thus providing the tension for this measurement. The anterior folds at the axillary fossa are eased under the tape. The lateral margin of the tape is fitted to the armscye, anterior and posterior, as well as the armscye-shoulder line intersection. The loop end of the tape is raised without unduly binding the posterior folds at the axillary fossa. The zero point of the tape is placed laterally with respect to the case end of the tape.

24. *Girth of upper arm, right* (pl. 6, *C*):

Landmarks.—Armscye-shoulder line intersection, olecranon.



Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture, feet together, arms relaxed at sides.

Position of observer.—The observer is at the right side of the subject with eyes at the level of measurement.

Procedure.—The tape is placed around the upper arm with the zero point at the center side. The girth is taken midway between the shoulder and the elbow without constriction. The plane of the girth is horizontal when the arm hangs relaxed, so that the principal long axis is approximately perpendicular to the floor.

25. *Girth of elbow, right* (pl. 6, D):

Landmark.—Olecranon.

Instrument.—Tape.

Position of subject.—The subject stands in normal erect position. The right arm is flexed at the elbow and the hand and fingers extended anteriorly. The angle of flexion is approximately 90 degrees. The upper arm is directed perpendicularly downward.

Position of observer.—The observer is at the right side of the subject, and with eyes at the level of the measurement.

Procedure.—The tape is placed around the arm, so that it passes over olecranon and bisects the angle of flexion. The zero point is situated centrally in front of the observer. The measurement is taken without constriction.

26. *Length of arm, posterior surface, upper segment, right* (pl. 6, E):

Landmarks.—Armseye-shoulder line intersection and olecranon.

Instrument.—Tape.

Position of subject.—The subject stands in normal erect posture with feet together. The right fist is placed on the hip with the dorsal side of the hand anterior. The arm is not flexed at the wrist.

Position of observer.—The observer stands back of the subject and at the right side.

Procedure.—The zero point of the tape is placed at the armseye-shoulder line intersection. The reading is made at olecranon. The tape is continued over the olecranon to the wrist.

27. *Total length of arm, posterior surface, right* (pl. 6, F):

Landmarks.—Armseye-shoulder line intersection, olecranon, and distal limit of the ulna.

Instrument.—Tape.

Position of subject.—Identical to that assumed for measurement No. 26.

Position of observer.—The observer stands to the right side and back of the subject. When the reading is made, the observer bends down under the point at the wrist so that the reading is made in the direct line of vision.

Procedure.—The zero point of the tape is placed at the armseye-shoulder line intersection. The tape passes over the olecranon to the landmark at the distal limit of the ulna. Care is exercised to prevent the tape from slipping off the olecranon. The measurement is taken with sufficient tension to maintain the tape in position at olecranon.

28. *Trunk line, right* (pl. 7, A):

Landmarks.—Right underarm midpoint and average waist level, right side.

Instrument.—Tape.

Position of subject.—The subject's position is normal erect posture with feet together. The observer asks the subject to relax his right arm and shoulder and permit him to place the arm in the desired position. The forearm is flexed at 90 degrees to the upper arm, and the hand is extended directly forward. While the observer steadies the subject's shoulder, he moves the entire arm thus flexed a few centimeters directly forward. The observer, still steadying the shoulder, then grasps the flexed elbow and tips it slightly upward until the underarm midpoint is just visible when the observer's eyes are at midtrunk level. The object of this detailed procedure is to expose the underarm midpoint without disturbing it significantly from its position when the arm hangs loosely at the side. Thus the position of the point during this measurement will be comparable to its position when the anterior arc of chest and girth of chest at armseye are measured.

Position of observer.—The observer sits at the right side of the subject with eyes at the level of the middle region of the trunk.

Procedure.—The zero point of the tape is placed at the underarm midpoint. The tape passes directly to the average waist level. If the subject is wearing a bandeau, the tape may pass over or under the garment, whichever will disturb less the direct course of the tape between the landmarks.

29. *Length from waist to hip, right* (pl. 7, C):

Landmarks.—Average waist level, average hip level right side.

Instrument.—Tape.

Position of subject.—The position in measurement No. 28 is maintained unaltered.

Position of observer.—Identical to that specified for measurement No. 28.

Procedure.—The zero point of the tape is placed at average waist level. The tape passes over the measuring garment. The reading is made at the average hip level.

30. *Maximum girth of thigh* (pl. 7, B):

Landmarks.—None indicated.

Instrument.—Tape.

Position of subject.—The subject's position is his normal erect posture with hands on hips. The feet are parted a few centimeters to permit the tape to pass freely between the medial surfaces of the thighs. The subject stands on a stool or chair so that the level of the gluteal fold can be seen conveniently in the observer's direct line of vision.

Position of observer.—The observer is at the subject's right side with eyes at the level of the gluteal fold.

Procedure.—The tape is placed around the thigh with the upper border at the level of the gluteal fold. The plane of the girth is horizontal. The zero point is situated directly in front of the observer at the right side of the subject's thigh. After the tape is placed the observer passes to the front of the subject and checks the plane of the girth. If the gluteal fold is not distinguishable the fold can be expressed by pressure on the right buttock. If several folds are so produced the major of these is selected.

Medially, the tape passes over the thigh at its largest part. The measurement is taken without constricting the thigh.

31. *Maximum girth of calf* (pl. 7, D):

Landmarks.—None indicated.

Instrument.—Tape.

Position of subject.—Position assumed for measurement No. 30 is maintained.

Position of observer.—The observer squats at the right side of the subject with eyes at the midlevel of the tibia.

Procedure.—The tape passes around the calf at the level where the observer judges the girth to be maximum. The level is determined by inspection of the posterior profile of the calf. The plane of the girth is horizontal and the measurement is taken without constriction of the calf.

32. *Girth of knee at tibiale* (pl. 7, E):

Landmark.—Tibiale.

Instrument.—Tape.

Position of subject.—Same as that described for measurement No. 30.

Position of observer.—The observer squats in front of the subject with eyes at the level of tibiale.

Procedure.—The tape is placed around the knee with the upper border at the level of tibiale. The zero point is situated at the center front. The plane of the girth is horizontal. The measurement is taken without constricting the knee.

33. *Length of crotch, total* (pl. 7, F):

Landmarks.—Average waist level, anterior and posterior.

Instrument.—Tape.

Position of subject.—The subject is asked to pull up the suit by the waist band to insure a snug adjustment of the measuring suit at the crotch. The left foot is placed on a stool or other steady object, which elevates the left foot to the midlevel of the right patella. The weight is evenly divided between the two feet. The long axis of the right leg is approximately perpendicular. The right foot is directed straight forward. The left hand rests on the left thigh. The head and trunk are erect. The principal transverse axis of the pelvis is approximately horizontal.

Position of observer.—The observer is at the left side of the subject while placing the zero point. He is at the center back with eyes at average waist level when the reading is made.

Procedure.—The zero point of the tape is placed anteriorly at the average waist level. The subject holds the tape in position with two fingers flat against the abdomen, spread so that the position of the zero point can be checked without moving his fingers. On very young children, the observer holds the zero point in position. The tape passes centrally through the crotch and up to the average waist level, posterior. The tension of the tape is about that provided by the weight of the tape case.

34. *Length of crotch, anterior*:

Landmarks.—Average waist level, anterior, and median line of medial surface of thigh at crotch level.

Instrument.—Tape.

Position of subject.—Position for measurement No. 33 is maintained.

Position of observer.—The observer squats at the subject's left side with eyes at crotch level.

Procedure.—The zero point of the tape is at average waist level, anterior. When the reading of total length of crotch has been made, the observer drops the tape from the average waist level, posterior, to crotch level. There the tape is supported on the observer's left index finger, and the case hangs free providing the tension desired for this measurement. The tape is lowered from the crotch by the width of the tip of the observer's index finger so that the observer can grasp the tape between the right index finger and thumb at the medial landmark of the thigh. This landmark is the reading point for the measurement.

35. *Extreme bend* (pl. 8, A):

Landmarks.—Midpoint at the knee, posterior, and the average waist level centered with reference to the median sagittal plane and the midaxillary position.

Instrument.—Tape.

Position of subject.—The subject stands with feet together facing a chair or stool which is about 2 feet away. He bends over at the hips and grasps the legs of the chair, or otherwise brings his hands to rest so that they are approximately at the midlevel or the lower border of the patella. The head is allowed to drop forward. The legs are straight and perpendicular to the floor. It is necessary to adjust the position of the chair so that the legs and arms can be brought to the desired positions without discomfort for the subject.

Position of observer.—The observer is back of the subject. He squats with eyes at knee level while the direction of the tape is checked and the reading is made.

Procedure.—The zero point of the tape is placed at the average waist level to the right of the median sagittal plane. The tape passes without constriction over the buttock to the midpoint of the knee. The medial border of the tape throughout its course is equidistant from the median sagittal plane. That is to say, the arc of the tape, although fixed at the landmarks, does not swing medially or laterally. The reading is made at the midpoint of the knee, posterior.

36. *Vertical trunk girth* (pl. 8, B):

Landmarks.—Neck base-shoulder line intersection, and armscye-shoulder line intersection.

Instrument.—Tape.

Position of subject.—The subject is asked to pull up the measuring garment by the waist band. The subject's position is his normal erect posture. The feet are placed a few inches apart so that the tape can pass freely between the thighs.

Procedure.—The tape is drawn out about one meter. The zero end is passed between the ankles and brought up over the right shoulder to meet the other tape end which is brought up from the crotch. On the shoulder, the tape lies midway between the neck base and the armscye. Posteriorly, in the crotch, the tape passes between the buttocks. Anteriorly, at the crotch, the tape passes centrally over the genitals without constriction. The breathing excursion, if any, is to be observed and the midpoint is read. Care should be taken not to put pressure on the crotch.

(Case No. ....)

UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF HOME ECONOMICS

STUDY OF BODY MEASUREMENTS FOR SIZING CHILDREN'S GARMENTS AND PATTERNS  
MEASUREMENT BLANK

(Write only on solid lines—NOT on dotted lines or in boxes)

(a) Marker \_\_\_\_\_ (b) Measurer \_\_\_\_\_ (c) (Squad.....) 1.

(d) Name of child \_\_\_\_\_ (e) (State.....) 2.

(f) Address of parent or guardian \_\_\_\_\_  
(Post-office address) (County or town) (State)

(g) Check one: Rural farm \_\_\_\_\_; rural nonfarm \_\_\_\_\_; urban \_\_\_\_\_  
(Town of over 2,500)

(h) Date of measuring \_\_\_\_\_  
(Day) (Month) (Year)

(i) Date of child's birth \_\_\_\_\_  
(Day) (Month) (Year)

..... (j) (Age.....) 3.

(k) Birthplace of father \_\_\_\_\_ Birthplace of mother \_\_\_\_\_  
(If U. S. A. give State; if foreign country give nation, town, province)

(l) Sex (check one) { Male \_\_\_\_\_ (m) (Nativity.....) 4.   
Female \_\_\_\_\_ 5.

(n) Social-economic group (check one) { A \_\_\_\_\_ 6.   
B \_\_\_\_\_  
C \_\_\_\_\_

(o) REMARKS: \_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_

(Write only on solid lines—NOT on dotted lines or in boxes)

1. Height of waist	_____			25. Gir. elbow	_____		
2. Height of hips	_____			26. L. arm post. up.	_____		
3. Weight (lb.)	_____			27. L. arm post. T.	_____		
4. Stature	_____			28. Trunk line	_____		
5. Ht. cervicale	_____			29. Waist to hips	_____		
6. Ht. tibiale	_____			30. Gir. thigh	_____		
7. Ht. crotch	_____			31. Gir. calf max.	_____		
8. Bitrochanteric	_____			32. Gir. knee tib.	_____		
9. Slope shoulder, R.	_____			33. Crotch L. T.	_____		
10. Width chest ant.	_____			34. Crotch L. ant.	_____		
11. L. waist ant.	_____			35. Extreme bend	_____		
12. Wid. ch. post.	_____			36. Gir. trunk vert.	_____		
13. L. waist post.	_____			37. (Chest/stature)	-----		
14. Gir. chest scye	_____			38. (Diff. chest)	-----		
15. Depth scye	_____			39. (G. lower arm)	-----		
16. Back arc hips	_____			40. (G. wrist)	-----		
17. Gir. chest max.	_____			41. (L. arm ant. up.)	-----		
18. Ant. arc chest	_____			42. (L. arm ant. T.)	-----		
19. Gir. waist	_____			43. (G. knee min.)	-----		
20. Gir. hips	_____			44. (G. ankle)	-----		
21. Gir. neck base	_____			45. (G. waist sgt.)	-----		
22. Shoulder length	_____			46. (Ht. waist sgt.)	-----		
23. Gir. armscye	_____			47. -----	-----		
24. Gir. upper arm	_____			48. -----	-----		

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UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF HOME ECONOMICS

STUDY OF BODY MEASUREMENTS FOR SIZING CHILDREN'S GARMENTS AND PATTERNS

Chief Aide's Statement

a. Name of child measured \_\_\_\_\_

b. Name of parent or guardian \_\_\_\_\_

c. Address of parent or guardian \_\_\_\_\_

d. Schedule 3: Unnecessary \_\_\_\_\_ Lost \_\_\_\_\_ Not obtainable \_\_\_\_\_  
(Check one) Submitted \_\_\_\_\_

e. Date of child's birth \_\_\_\_\_ f. S. of I.<sup>1</sup> \_\_\_\_\_  
(Day) (Month) (Year)

g. Place of child's birth \_\_\_\_\_ h. S. of I.<sup>1</sup> \_\_\_\_\_  
(State)

i. List of full brothers and sisters: j. S. of I.<sup>1</sup> \_\_\_\_\_

Names

Relationship to child  
(brother or sister)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

k. Birthplace of father \_\_\_\_\_ l. S. of I.<sup>1</sup> \_\_\_\_\_  
(Nation) (State)

m. Birthplace of mother \_\_\_\_\_ n. S. of I.<sup>1</sup> \_\_\_\_\_  
(Nation) (State)

o. Present occupation of child's principal supporter \_\_\_\_\_ p. S. of I.<sup>1</sup> \_\_\_\_\_

q. Nature of the work (i. e., skilled or unskilled) \_\_\_\_\_  
What are the duties and activities \_\_\_\_\_

r. Has the child's family ever received public relief, including work relief? Yes \_\_\_\_\_ No \_\_\_\_\_ s. S. of I.<sup>1</sup> \_\_\_\_\_

t. Has the child's family ever received relief from a private agency? Yes \_\_\_\_\_ No \_\_\_\_\_ u. S. of I.<sup>1</sup> \_\_\_\_\_

v. Further remarks on social-economic grouping \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

w. Recommended social-economic group: A \_\_\_\_\_ Signed \_\_\_\_\_  
(Check one) B \_\_\_\_\_ (Chief aide)  
C \_\_\_\_\_

<sup>1</sup> Means source of information.

UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF HOME ECONOMICS

STUDY OF BODY MEASUREMENTS FOR SIZING CHILDREN'S GARMENTS AND PATTERNS

Parent's or Guardian's Statement

Name of child measured \_\_\_\_\_

Parent's or guardian's name \_\_\_\_\_

Address \_\_\_\_\_  
(R. F. D. or street) (Town) (State)

How old was this child on <sup>his</sup> last birthday? \_\_\_\_\_ years.  
<sub>her</sub>

What is the date of <sup>his</sup> next birthday? \_\_\_\_\_  
<sub>her</sub> (Day) (Month) (Year)

In what State was this child born? \_\_\_\_\_

What are the names of this child's brothers? (Please do not list half-brothers, cousins, and adopted children.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What are the names of this child's sisters? (Please do not list half-sisters, cousins, and adopted children.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

In what country was the child's father born? \_\_\_\_\_

In what country was the child's mother born? \_\_\_\_\_

What is the present job, trade or business of the child's guardian (father, mother, or whoever cares for the child)? \_\_\_\_\_

# Reliability of Recorded Information

## Description of the Schedules

The front and reverse sides of the printed schedule upon which the original measuring record was made are shown on pages 17 and 18. This was designated as schedule 1. Schedule 2 (p. 19) was used by the chief aides of the measuring squads to assist in assembling the supplementary information listed on the front of schedule 1. When this could not be secured from the child, from the school, or from other public records or authorities, schedule 3 (p. 20) was sent to the parent or guardian with the request that it be filled out and returned to the local measuring unit.

This supplementary information included the child's name, address, the classification of place of residence as rural or urban, the date the measurements were taken, the date of birth, the birthplace of the father and of the mother, the child's sex, and the socioeconomic group in which the family might be classified.

The distinction between the terms "urban" and "rural" was based on the size of the population. Cities and towns with a population of 2,500 or more were considered urban communities. Those with a population of less than 2,500 and areas outside of towns were considered rural. A further distinction was made in the rural classification as between rural farm and rural nonfarm. If the main source of the family's income was from the farm or from pursuits chiefly agricultural, "rural farm" was checked on the schedule. If, however, the family lived in a rural community, but derived its income from some source other than the farm, "rural nonfarm" was checked.

The chief criterion for the socioeconomic classification was the occupation of the principal wage earner or supporter of the child's family. To make this socioeconomic classification more precise, additional information was given on schedules 2 and 3 as to the nature of the work done (i. e., professional, skilled, semiskilled, or unskilled), and a description of the duties and activities connected with the particular occupation. Whenever possible, a check of the rolls of relief agencies in the city in which the child lived was also made to determine whether or not his family had ever been on relief.

If the principal wage earner of the family was a professional or skilled worker, the family's socioeconomic status was classified as *A*. If the principal wage earner was a semiskilled or unskilled worker, or if, regardless of his present occupation, he had ever been on relief (including work relief), the family's socioeconomic status was classified as *B*. If, as in a very few cases, sufficient information was not available upon which to base a decision as to the socioeconomic status of the family, the family was classified as *C*.

## Editing of Schedules

The editing of the schedules was done in a statistical pool in Baltimore, Md. An editing scheme similar to the one used in Baltimore was also set up in many States where measurements were taken. Original data were transcribed on duplicate mimeographed schedules, and the editing in the field was performed on these schedules. No editing in the field was done on the original schedules. The field editing was set up for the sole purpose of detecting faulty techniques. For example, if a measurer showed frequent inconsistent results pertaining to a given item, the technique employed by that measurer in measuring that item was checked by the field supervisor.

There were two separate steps in the editing of the original schedules. First, the items on the front of schedule 1 were checked with the corresponding items on schedule 2 and schedule 3 (if submitted) to determine whether the items were identical or consistent.

From the date of the child's birth and the date he was measured, his age was computed in years, months, and days. The age was then entered in the appropriate space on the schedule, and coded in months, to the nearest month (15 days or more constituted an additional month).

Although the socioeconomic group was checked by the chief aide in the field, the editing division verified each entry. In case of apparent inconsistency between the status as checked and the basic information contained on the schedule, the field supervisor was contacted whenever possible for an explanation.

The second step in the editing of the schedules was to check the consistency of the body measurements of the children as recorded on the schedules. After a thorough analysis of the data obtained in a preliminary research, a consistency check was formulated with at least 2 checks on each of the 36 items. Most of these consistency checks made use of the fact that for certain body measurements the sum of the parts must equal the whole.<sup>4</sup>

Irregularities or inconsistencies in the body measurements recorded were classified in two main groups—omissions and gross errors. Errors were considered "gross" when the measurements, as recorded, were impossible—when hip height, for example, was recorded as larger than waist height; or anterior chest arc was recorded as larger than chest girth; or the upper posterior arm length was recorded as equal to or greater than total posterior arm length. Schedules containing

<sup>4</sup> For example, the numerical difference between waist height and hip height must of necessity equal or approximate the entry of item waist to hip. The sum of the entries in items waist height and posterior waist length must equal cervicale height, as must also the sum of hip height, waist to hips, trunk line, and scye depth.

gross errors were not eliminated from the study, but the items in which the gross errors occurred were eliminated. The number and percentage of omitted items and gross errors for each State are given in table 2.

TABLE 2.—Number and percentage of omissions and gross errors, classified by States

State	Total number of schedules edited	Total number of items	Type of irregularity					
			Gross errors			Omissions		
			Number	Percentage of schedules	Percentage of items	Number	Percentage of schedules	Percentage of items
Alabama.....	9, 118	319, 130	450	4.94	0.14	25	0.27	0.0078
California.....	5, 335	186, 725	188	3.52	.10	9	.17	.0048
Colorado.....	8, 787	307, 545	135	1.54	.04	1	.01	.0003
District of Columbia, Maryland, and Virginia.....	12, 571	439, 985	596	4.74	.14	146	1.16	.0332
Illinois.....	13, 612	476, 420	256	1.88	.05	35	.26	.0073
Iowa.....	8, 573	300, 055	469	5.47	.16	45	.52	.0150
Kansas.....	8, 219	287, 665	369	4.49	.13	19	.23	.0066
Michigan.....	4, 918	172, 130	213	4.33	.12	4	.08	.0023
Minnesota.....	12, 926	452, 410	882	6.82	.19	111	.86	.0245
Nebraska.....	7, 300	255, 500	187	2.56	.07	20	.27	.0078
Ohio.....	12, 193	426, 755	424	3.48	.10	192	1.57	.0449
Pennsylvania.....	8, 187	286, 545	496	6.06	.17	35	.43	.0122
Tennessee.....	6, 157	215, 495	217	3.52	.10	19	.31	.0088
Texas.....	7, 936	277, 760	325	4.10	.12	6	.08	.0022
Utah.....	9, 099	318, 465	255	2.80	.08	8	.09	.0025
Total.....	134, 931	4, 722, 585	5, 462	4.05	.12	675	.50	.0143

<sup>1</sup> The "total numbers" differ from those shown on pages 2 to 3, because schedules were omitted from the editing when for various reasons they could not be included in the analyses made in this report (see below). Moreover this table was prepared before all the schedules were collected. The total number of schedules edited for each State does not, therefore, necessarily correspond to the total number of schedules that went into the study for that State. Thus, although only 4,918 schedules for Michigan appear on this table, the actual number that went into the study was 10,597.

While 147,088 children were measured in the field, approximately 133,000 cases entered the final phase of the analysis. Thus approximately 14,000 cases were eliminated, in the main, for the reasons explained below.

Schedules for children who were not white, American-born, and between 4 and 17 years of age were excluded. When children presented themselves to be measured who were foreign born, of racial stock other than white, or were older or younger than the children being studied, it was often necessary to measure them in order to maintain good feeling in the groups of which they were a part.

If a measurer consistently showed large errors of measurement (see below), his schedules were eliminated. Also omitted were schedules showing internal inconsistencies that could not be resolved through correspondence with the field staff, schedules not containing essential information such as age or nativity, and all schedules that arrived too late for the analyses.

### Accuracy of Measurements

In discussing errors of measurements, both their size and their scatter or spread must be considered. If a measurer does not display a systematic bias, his errors of measurement in the long run will tend to cancel. Therefore the mean of the measurements themselves for large samples, will be unaffected by such errors. However, the variations of the measurements will be inflated by the variation of the errors made in

measuring.<sup>5</sup> Since the variations of the measurements play a major role in a study of this kind, an estimate of the variation in the errors of measuring is of importance.

The methods used in arriving at an estimate of the accuracy of measurement were based on duplicated measurements. Two major types of duplications were used in this study. Children were either measured twice by the same person or measured twice by different persons. Duplicate measurements obtained by the first process were termed "self duplicates" and by the second process "cross duplicates." Cross duplicates were obtained between measurers and between measurers and instructors. The latter type was termed "instructional duplicates."

Self duplicates, in the main, were obtained as part of the routine in the training schools. Each measurer at the end of the training period was required to measure approximately 10 children. The differences between the measurements of the first and second trials were tabulated for each measurer for each of 33 measurements. Since there was a total of 266 trainees this study yielded for each measurement 266 means and the same number of variances<sup>6</sup> calculated from the differences between the 10 self duplicates. These 266 means and variances in samples of 10 were then pooled to get an estimate of the performance of the total group of measurers.

Cross duplicates were obtained both in the training schools and in the field. In the field each measurer was instructed to remeasure periodically a child measured by another measurer. The cross duplicates were not used as a basis for estimating the extent of error of a measurer.<sup>7</sup> They did, however, serve as a useful check on the proficiency of the measurers. Thus when cross duplicates showed large differences between measurers, the technique of those involved was checked, and unsatisfactory measurers were assigned to other duties.

The instructional duplicates were also useful in checking the proficiency of the measurers. These duplicates, for the most part, were obtained in the training schools, where the instructor remeasured the same 10 children that were measured by the trainees. Differences between the measurements taken by the instructor and the trainee were tabulated. From these differences, means and variances were computed for each measurer on each of the samples of 10 children giving rise to 245 means and 245 variances for each of

<sup>5</sup> Statistically this may be shown by the following: Let  $X$  be a measurement (such as stature) taken on children by a measurer  $A$ . Let  $x$  be the true measurement and  $e$  the error of measurement. Then  $X = x + e$ . The symbol  $EX$  will denote the mean value of  $X$  and the symbol  $\sigma_X$  will denote the standard deviation of  $X$ . The variance of  $X$  is the square of the standard deviation of  $X$ . It may be shown that  $EX = Ex + Ee$  and, if the correlation of  $x$  and  $e$  is zero, that  $\sigma_X^2 = \sigma_x^2 + \sigma_e^2$ . If it is assumed that the mean value,  $Ee$ , of the errors of measurement is zero then it follows that  $EX = Ex$ , or in other words that, for large samples, the mean of the measurement will not be affected by the errors of the measurer. Furthermore, if the errors of measurement are not correlated with the measurement itself, then the variance,  $\sigma_X^2$ , of the measurement  $X$  will be equal to the sum of the variance,  $\sigma_x^2$ , of the true measurement  $x$  and the variance  $\sigma_e^2$ , of the error of measurement  $e$ . Consequently, the larger the variance of  $e$ , the greater will be the increase in the variance of the measurement due to errors of the measurer.

<sup>6</sup> It can be shown that if the errors are not correlated with the measurements themselves or with each other, one-half of the variance of the difference of self duplicates is an estimate of the variance of the error of measurement.

<sup>7</sup> The set of cross duplicates obtained was not large enough to permit a valid estimate of error of measurement for individual measurers. If sufficiently large numbers of cross duplicates were available, it would have been possible to get such estimates. For instance, if it were possible to get three measurers each to measure the same large group of children, then an estimate of the variance of error for each one could be obtained under the condition that the errors made by one are not related to the measurement nor to the errors made by the other measurers. Thus, if  $X$ ,  $X'$  and  $X''$  are the performances of each of the three measurers on the same child and  $e$ ,  $e'$ ,  $e''$  are their respective errors of measurement then  $\sigma_{d_1}^2 = \sigma_x^2 + \sigma_{e'}^2$ ,  $\sigma_{d_2}^2 = \sigma_x^2 + \sigma_{e''}^2$  and  $\sigma_{d_3}^2 = \sigma_x^2 + \sigma_e^2$ . Here  $d_1 = X - X'$ ,  $d_2 = X - X''$  and  $d_3 = X' - X''$ . If an estimate of  $\sigma_{d_1}^2$ ,  $\sigma_{d_2}^2$  and  $\sigma_{d_3}^2$  is obtained from a large sample, the above three simultaneous equations with three unknowns may be solved for  $\sigma_x^2$ ,  $\sigma_{e'}^2$  and  $\sigma_{e''}^2$ .



the measurements. Pooled means and pooled variances also were obtained.

Table 3 gives for self and instructional duplicates the mean difference and the standard deviation of the differences for each of 33 measurements.<sup>8</sup>

Since the ranges for these measurements are not the same, the standard deviations of the differences of these measurements are not exactly comparable. In order to make comparisons between these quantities meaningful, each standard deviation was expressed as a percentage of the mean of that measurement for the age group involved. These percentages are also given in table 3. It will be seen that, on a percentage basis, height (stature) was least subject to errors of measurement and trunk line most subject to such errors.

TABLE 3.—Mean difference and standard deviation of differences (in centimeters and in percent) of 2,660 self duplicates and of 2,450 instructional duplicates for each of 33 measurements

Measurement	Self duplicates			Instructional duplicates		
	Mean difference	Standard deviation of differences <sup>1</sup>		Mean difference	Standard deviation of differences <sup>1</sup>	
	Centimeters	Centimeters	Per-cent <sup>2</sup>	Centimeters	Centimeters	Per-cent <sup>2</sup>
Waist height	0.01	1.17	1.3	0.07	1.05	1.2
Hip height	-.05	1.24	1.8	.07	1.02	1.4
Stature	.01	.90	.7	-.09	.93	.7
Cervicale height	.08	1.53	1.3	-.08	1.15	1.0
Tibiale height	.02	1.07	2.8	.40	.90	2.4
Crotch height	-.06	1.66	2.6	.53	1.30	2.1
Bitrochanteric diameter	.04	.41	1.6	.06	.53	2.1
Anterior chest width	-.03	1.03	4.1	-.49	.94	3.8
Anterior waist length	-.09	1.69	6.1	-.31	1.24	4.5
Posterior chest width	.08	1.96	6.8	-.44	1.35	4.7
Posterior waist length	.12	1.26	4.1	-.32	1.26	4.1
Chest girth at armseye	-.08	1.64	2.4	-.09	1.54	1.9
Sceye depth	.03	1.45	9.7	.07	1.18	7.9
Posterior hip arc	.05	2.27	6.6	-.13	1.49	4.4
Anterior chest arc	-.08	2.30	6.3	.81	2.19	6.0
Waist girth	-.10	2.11	3.6	-.55	2.10	3.5
Hip girth	-.04	.82	1.2	-.37	.89	1.3
Neck-base girth	-.06	.84	2.6	-.29	.76	2.4
Shoulder length	.03	.47	5.1	-.08	.38	4.2
Armscye girth	.05	1.18	3.6	.24	1.07	3.3
Upper-arm girth	-.01	.37	1.9	.04	.44	2.2
Elbow girth	.04	.94	4.2	.18	.81	3.6
Upper posterior arm length	.00	.68	2.4	-.05	.54	1.9
Total posterior arm length	-.03	.99	2.0	-.06	.76	1.5
Trunk line	-.01	1.55	9.8	-.97	1.49	9.4
Waist to hip	.06	1.32	7.9	.24	1.32	7.9
Thigh girth	-.03	.82	2.0	-.33	1.42	3.5
Maximum calf girth	.01	.35	1.3	-.08	.47	1.7
Knee girth	-.01	.69	2.4	-.13	.60	2.1
Total crotch length	.13	3.77	6.6	.25	3.88	6.8
Anterior crotch length	.09	2.38	8.3	.00	2.46	8.6
Extreme bend	-.07	2.51	4.3	.19	2.46	4.2
Vertical trunk girth	.12	3.26	2.7	-.90	3.14	2.6

<sup>1</sup> These quantities were calculated by taking the square root of the weighted average of the sample variances (see appendix footnote 4) obtained for each measurer from the differences between his duplicates. The weights were one less than the number of duplicates per measurer.

<sup>2</sup> The figures in this column give the standard deviation of the differences in terms of percent of the mean of the measurement for the age group 6 to 14.

To obtain a clearer picture of the performance of the total group of measurers, the percentage frequency distribution of the means and variances of the differences, in samples of 10 for both self and instructional duplicates, were plotted for each of 33 measurements. It was

<sup>8</sup> It should be pointed out that since single landmarks were used in taking several body measurements, there is reason to assume the correlation of errors in different measurements on the same person.

found that the means, in general, have a fairly symmetrical distribution concentrating around zero. The variances have a form that appears to be similar to that of the "chi-square" distribution. Figure 5 shows the distribution of these quantities for 12 important measurements.

### Accuracy of Supplemental Information

In addition to the editing of the schedules (p. 21), a supplementary check was made for all States on the consistency with which the following items were recorded on schedules: The date of the child's birth,<sup>9</sup> the birthplace of his mother; and the socioeconomic group in which his family belonged. For this check, all schedules No. 2 pertaining to members of the same family (full brothers and/or sisters only) were segregated by matching names and addresses of parents and names of siblings.

Since these schedules pertain to the same families the following were considered inconsistencies: Birth dates of siblings (except twins) recorded as less than a biologically reasonable number of months apart; the birthplace of the parents of siblings recorded as different countries; or the socioeconomic rating of the siblings reported as different.

The percentage of inconsistencies was calculated separately for families in which two siblings were measured and for families in which three siblings were measured. Table 4 gives the results of this study.<sup>10</sup>

<sup>9</sup> In general the date of hirth of a child was obtained from school records. Whenever possible it was corroborated by information obtained from the parents. In case of the older children in many instances the recorder relied entirely upon the information supplied by the child himself.

<sup>10</sup> On the basis of the percent inconsistencies given in table 4, it is possible to get an estimate of the probability of classifying a child in the wrong socioeconomic group. (Since very few children were classified in socioeconomic group C, only groups A and B will be considered.)

Let  $p$  be the probability of classifying a child in the wrong socioeconomic group. Furthermore let  $P_1$  be the probability of getting an inconsistency in families where two children were measured and  $P_2$  be the probability of getting an inconsistency in families where three children were measured. If (as may be assumed) the children in a given family were classified independently, then

$$P_1 = 2p(1-p) \quad (1)$$

and

$$P_2 = 3p(1-p) \quad (2)$$

If estimates of  $P_1$  and  $P_2$  are available, then it is possible to obtain from equations (1) and (2) two independent estimates (say  $p_1$  and  $p_2$ ) for the probability  $p$ . The asymptotic standard errors of  $p_1$  and  $p_2$  are given by

$$\sigma_{p_1} = \frac{1}{2} \left[ \frac{P_1(1-P_1)}{N_1(1-2P_1)} \right]^{1/2} \quad (3)$$

and

$$\sigma_{p_2} = \left[ \frac{P_2(1-P_2)}{3N_2(3-4P_2)} \right]^{1/2} \quad (4)$$

where  $N_1$  stands for the number of families in which two children were measured and  $N_2$  stands for the number of families in which 3 children were measured.

The value 0.154 (see table 4) was taken as an estimate of  $P_1$  and the value 0.211 was taken as an estimate of  $P_2$ . Equation (1) then yielded for  $p_1$  the value 0.0840 and equation (2) yielded for  $p_2$  the value 0.0760. (It is to be noticed that two values of  $p$  satisfy each of the equations (1) and (2). However, since the classification of children was not a random process, it seemed reasonable to take the smaller of the two values.) Equations (3) and (4) yielded 0.0018 and 0.0028 as estimates of the standard errors of  $p_1$  and  $p_2$  respectively.

The above seems to indicate that in the present study approximately 8 children out of every hundred were placed in the wrong socioeconomic classification. This conclusion would be much strengthened if the small difference between the two independent estimates of  $p$  were found to be nonsignificant. However, the following consideration shows that the difference may be significant.

The difference between  $p_1$  and  $p_2$  is 0.0080. The standard error of the difference, however, can be shown to be 0.0033. Thus the difference between the two estimates of  $p$  is approximately  $2\frac{1}{2}$  times its standard error. In view of the size of the sample, this difference may be considered significant.

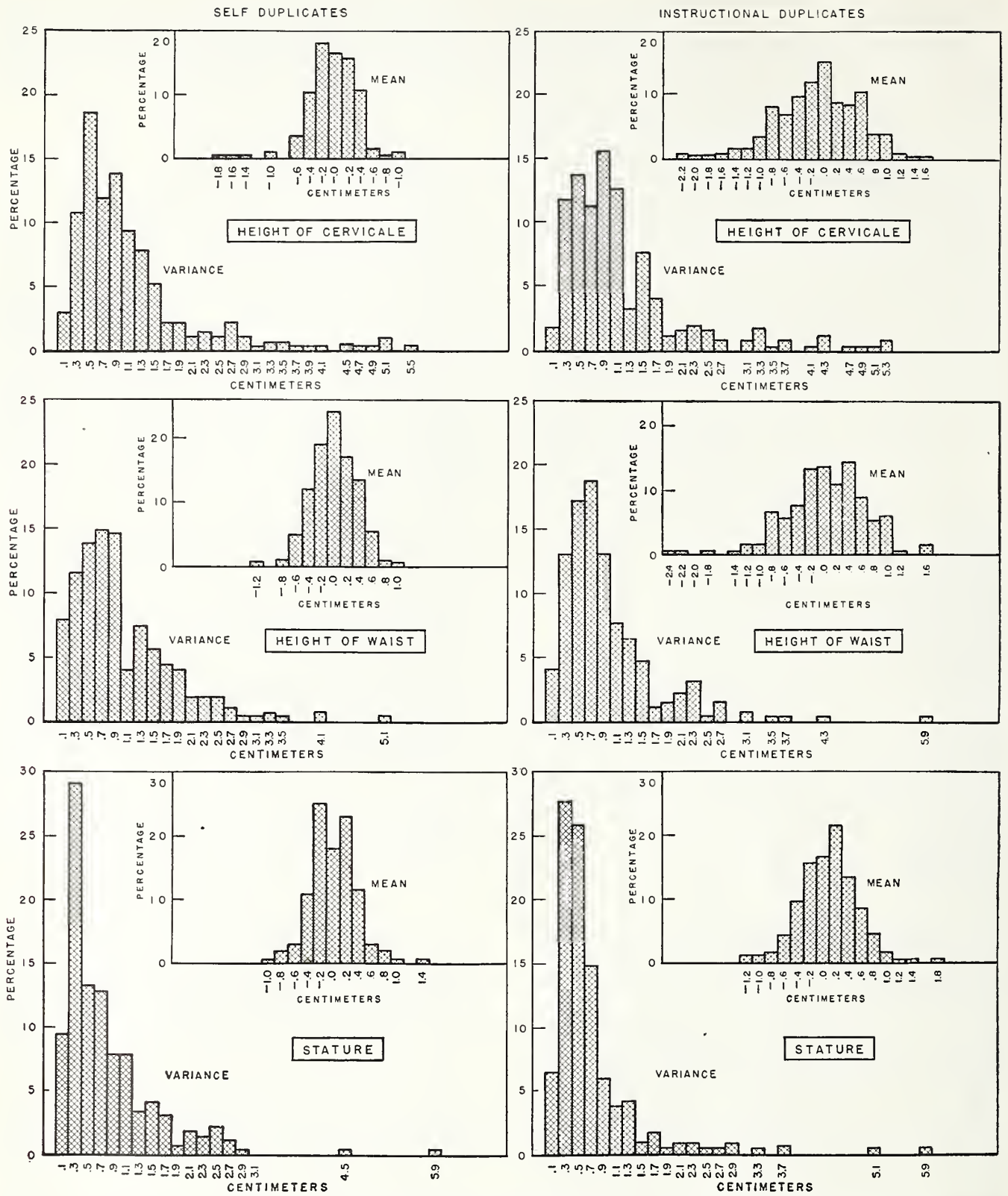


FIGURE 5, A.—Percentage frequency distributions of means and variances (based on 10 observations) of differences between duplicated measurements (self duplicates and instructional duplicates): Height of cervicale, height of waist, and stature.

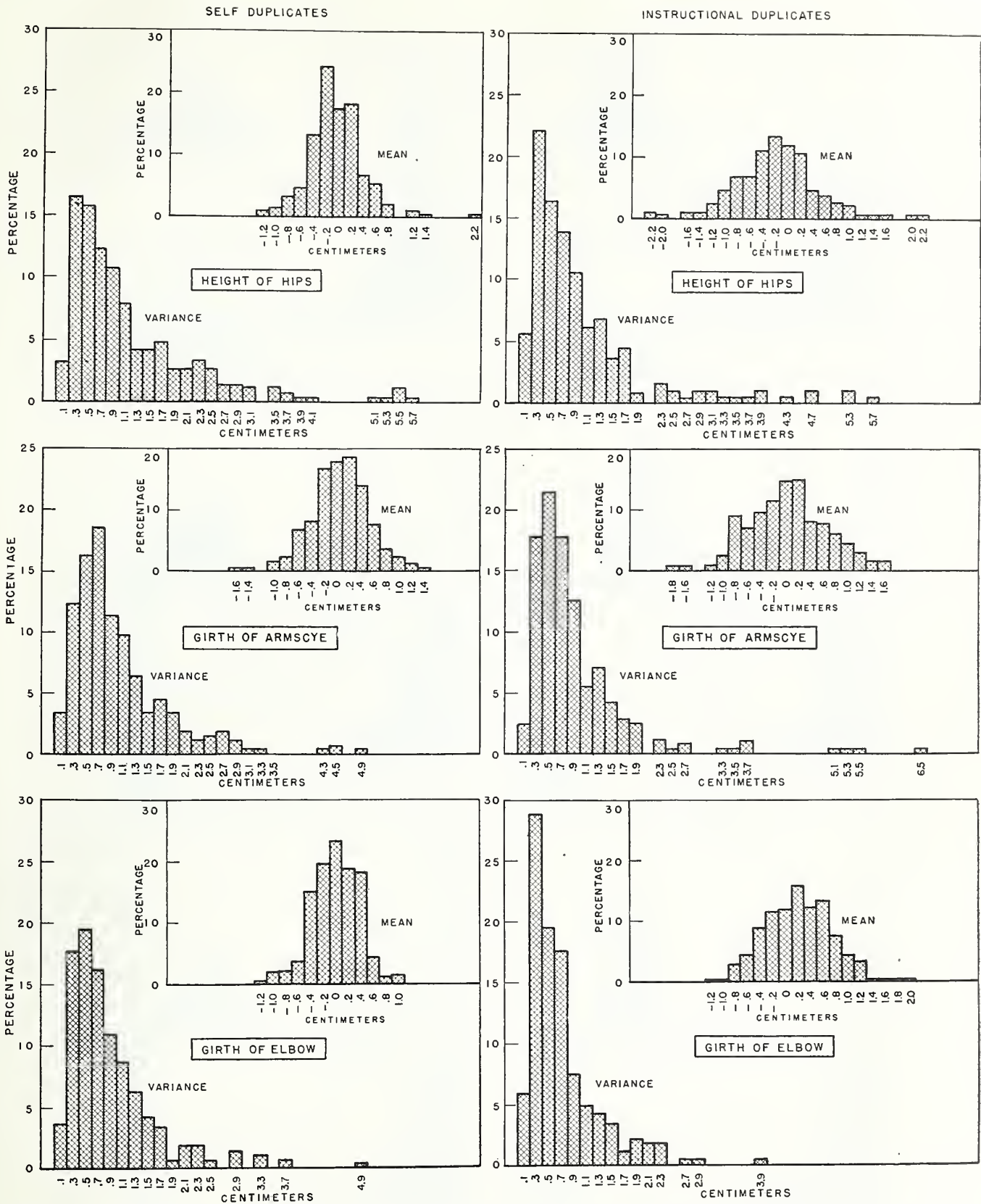


FIGURE 5, B.—Percentage frequency distributions of means and variances (based on 10 observations) of differences between duplicated measurements (self duplicates and instructional duplicates): Height of hips, girth of armscye, and girth of elbow.

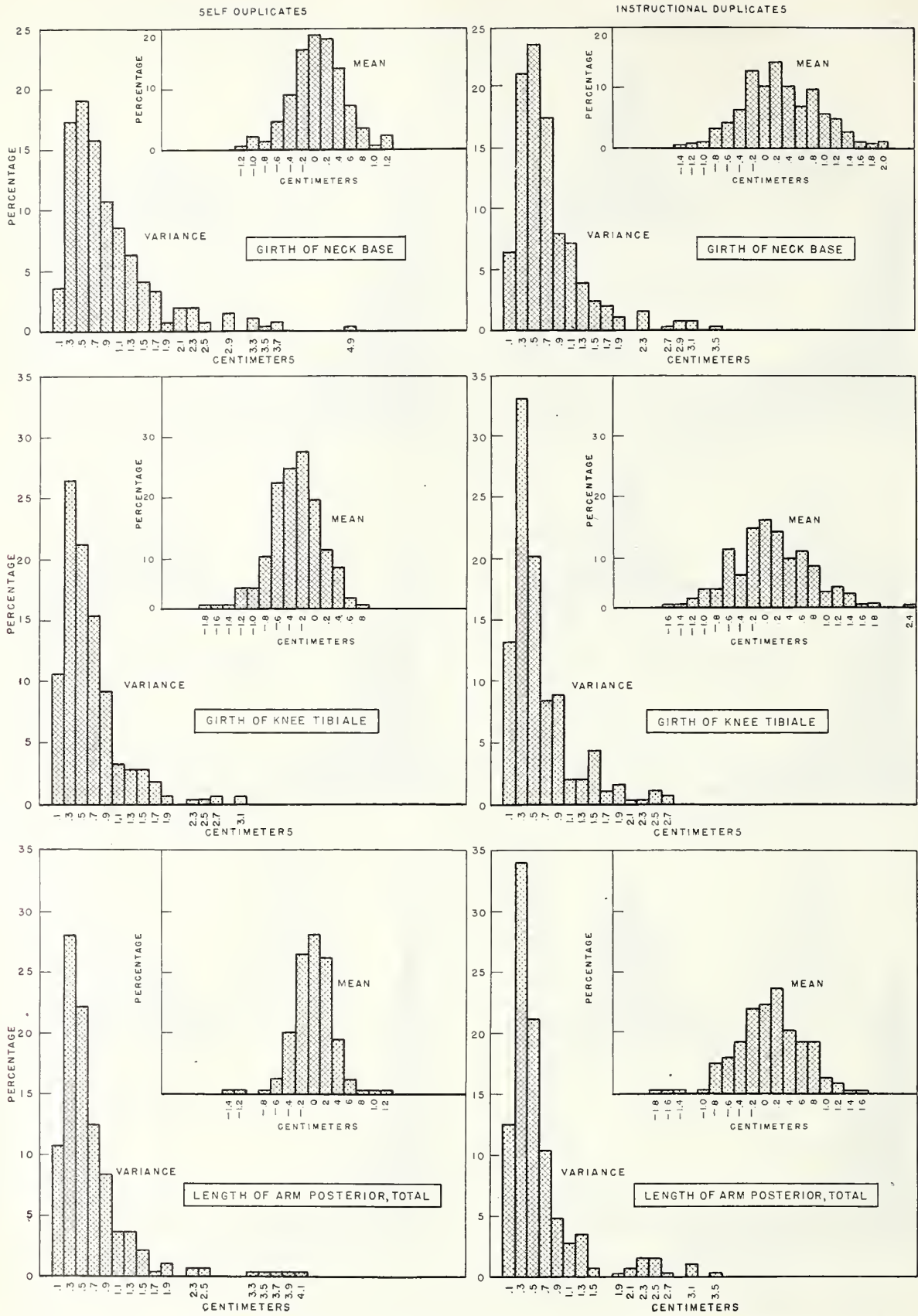


FIGURE 5, C.—Percentage frequency distributions of means and variances (based on 10 observations) of differences between duplicated measurements (self duplicates and instructional duplicates): Girth of neck base, girth of knee tibiale, and length of arm posterior, total.

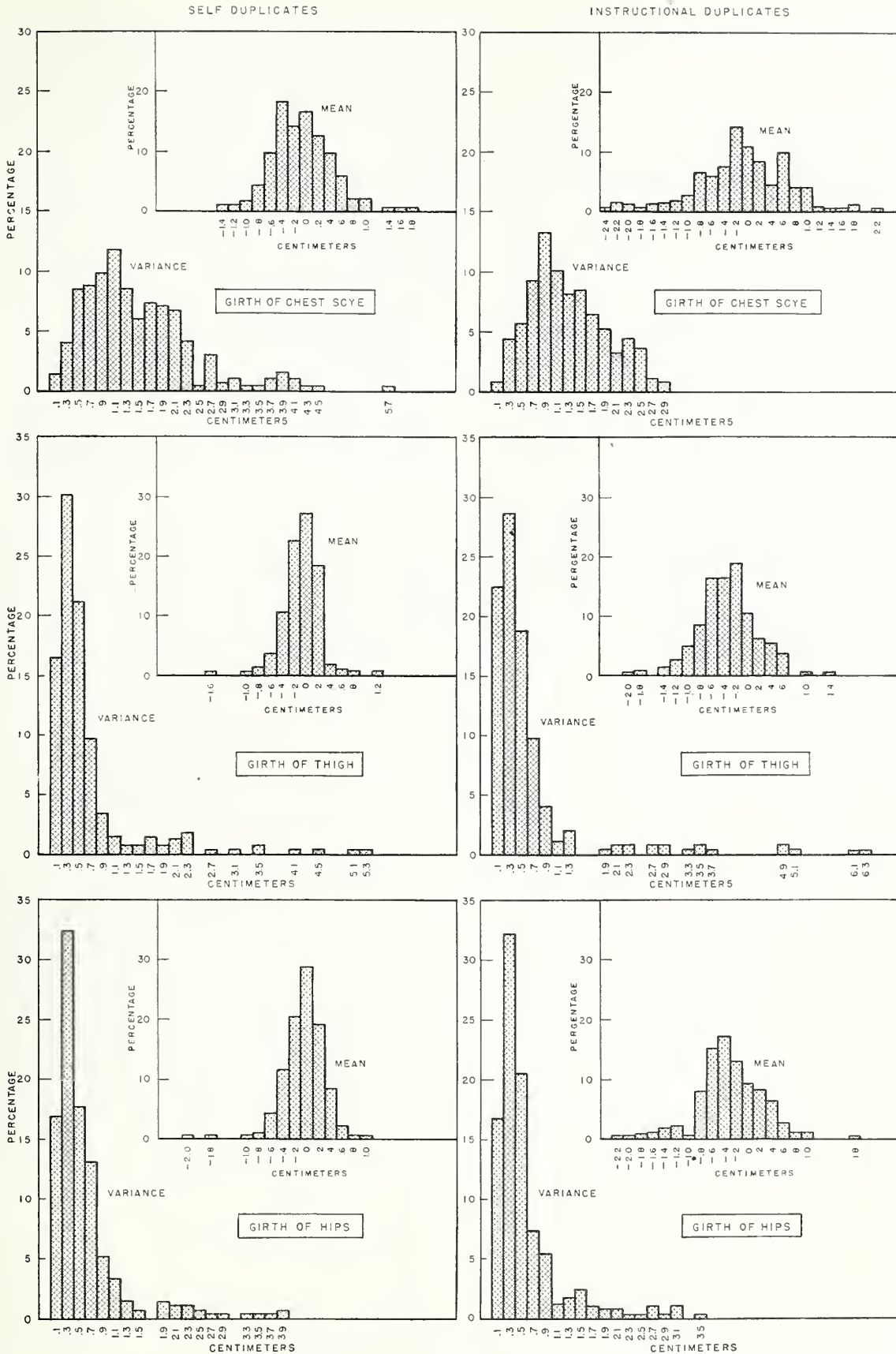


FIGURE 5, D.—Percentage frequency distributions of means and variances (based on 10 observations) of differences between duplicated measurements (self duplicates and instructional duplicates): Girth of chest scye, girth of thigh, and girth of hips.

TABLE 4.—Number and percentage of inconsistencies by State and by number of children measured per family

State	Number measured in each family	Number of families	Number of inconsistent reports			Percentage of inconsistent reports		
			Date of birth	Birth-place of parents	Socio-economic group	Date of birth	Birth-place of parents	Socio-economic group
Alabama	2	1,415	25	3	179	1.8	0.2	12.7
	3	449	10	2	84	2.2	.4	18.7
California	2	801	7	19	30	.9	2.4	3.7
	3	147	5	6	4	3.4	4.1	2.7
Colorado	2	1,180	49	116	178	4.2	9.8	15.1
	3	357	19	55	61	5.3	15.4	17.1
Dist. of Col., Maryland, and Virginia	2	1,012	38	94	179	3.8	9.3	17.7
	3	152	15	14	52	9.9	9.2	34.2
Illinois	2	764	29	117	155	3.8	15.3	20.3
	3	122	8	41	33	6.6	33.6	27.0
Iowa	2	1,199	135	19	10	11.3	1.6	.8
	3	261	43	15	8	16.5	5.7	3.1
Kansas	2	1,037	8	14	104	.8	1.4	10.0
	3	243	3	4	29	1.2	1.6	11.9
Michigan	2	609	37	98	139	6.1	16.1	22.8
	3	80	3	34	36	3.8	42.5	45.0
Minnesota	2	1,315	35	286	303	2.7	21.7	23.0
	3	271	6	152	94	2.2	56.1	34.7
Nebraska	2	1,047	41	41	183	3.9	3.9	17.5
	3	226	10	20	56	4.4	8.8	24.8
Ohio	2	1,066	36	57	164	3.4	5.3	15.4
	3	213	8	9	49	3.8	4.2	23.0
Pennsylvania	2	829	20	89	141	2.4	10.7	17.0
	3	137	5	14	21	3.6	10.2	15.3
Tennessee	2	843	29	164	196	3.4	19.5	23.3
	3	266	16	73	88	6.0	27.4	33.1
Texas	2	901	16	18	112	1.8	2.0	12.4
	3	109	4	0	15	3.7	0	13.8
Utah	2	892	39	50	222	4.4	5.6	24.9
	3	167	17	11	44	10.2	6.6	26.3
Total	2	14,910	544	1,185	2,295	3.6	7.9	15.4
	3	3,200	172	450	674	5.4	14.1	21.1

The estimate of errors in the date of the child's birth based on siblings is not very satisfactory since, by the very nature of the check used, only small deviations could be detected. In order to get a better estimate of the percentage of error in the age of the children measured, a more refined study was made in the States of Illinois and Ohio.

In these two States the recorders in the field were requested, wherever possible, to submit information on the birth date of the child. This information could be obtained from sources independent of those used in recording the original schedules. In general, these independent sources were the original birth certificates of the children.

The birth dates obtained from these sources were compared with the original entries of birth date, and the percentage of inconsistencies according to extent of the deviations from the original entries was calculated (table 5).

TABLE 5.—Number and percentage of inconsistencies in age determined from an analysis of 5,601 schedules from Illinois and 4,922 from Ohio

Extent of deviation	Number		Percentage of total	
	Illinois	Ohio	Illinois	Ohio
Under 1 year	125	113	2.2	2.3
1-2 years	163	87	2.9	1.8
2-3 years	11	16	.2	.3
3 years and over	4	8	.1	.2
All deviations	303	224	5.4	4.6

# Determination of Control Measurements as a Basis for Sizing

It was recognized at the beginning of the project that the interests of users and manufacturers of garments, patterns, and forms, would not be served if the measurements obtained through this study were reported merely on the basis of age. It was evident that there needed to be a further analysis. There was the possibility that a classification might be found that would more effectively group children of similar build. Such a classification might then eventually be used in a more satisfactory system of sizing. A consideration of the statistical problems involved (p. 133), led to the conclusion that the first step was to attempt to find a control measurement or combination of measurements upon which such a classification could be formulated.

The determination of these control measurements was undertaken on three independent samples. The first 8,000 schedules for boys and 8,000 for girls that arrived from the field made up the first sample. The second sample also consisted of 8,000 schedules for boys and 8,000 for girls. The next 16,000 schedules for boys and 16,000 for girls made up the third sample. All of these were records of children 4 to 14 years of age. Each of the three samples gave similar results and the analysis reported here covers all of these, totaling approximately 64,000 cases.

## Distributions of Body Measurements

The first objective in the analysis was to determine the types of distribution that might be expected from the body measurements. To this end, 20 out of the 36 measurements including age were chosen, and a bivariate frequency diagram was obtained for each possible pair. This was done for each sample for boys and girls separately. Among other things, these bivariate frequency distributions yielded a general view of the extent of variation, the relationships between measurements, the effect of growth on the distributions, and the departure from linearity of the regression of one measurement on another. In general, when the averages of one measurement for a constant unit of the

other were calculated and plotted, the results yielded fairly smooth curves.

This cursory study showed: (1) That the bivariate frequency distributions obtained are fairly regular though not normal. This is especially true of the joint distribution of a girth and a length, where, for a constant unit of length the distribution of the girth tends to be skewed in the positive direction. (2) The regression of one length on another is fairly linear while the regression of girth or weight on length departs somewhat from linearity. The regression of weight on a length seems to follow a logarithmic curve (p. 70). (3) The scatter or spread obtained from a bivariate frequency distribution of two lengths or two girths appears to be smaller than that obtained from a length and a girth. (4) The scatter of a length and a girth increased with the length or the girth so that the contours of equal probability are fan-shaped.

## Correlational Analyses

The second step in the determination of the control measurements was the calculation of the correlation coefficients for the 190 pairs of the 20 measurements considered. This calculation was made for each of the three samples and for each sex. Here, and throughout the study, unless otherwise stated, the unit of grouping was one centimeter for measurements, one pound for weight, and one month for age.

The set of correlations, which will be designated as the matrix of correlations, is given in tables 6 and 7. These tables were obtained by combining the three samples and therefore are based respectively on approximately 32,000 boys and 32,000 girls.

The entries below the main diagonal of the matrix are the correlations converted into  $z$  values ( $1$ ).<sup>11</sup> These transformed correlations are useful in tests of significance since their distributions are close to normal and their asymptotic standard errors do not involve population parameters.

<sup>11</sup>  $z = \frac{1}{2} \log_e \frac{(1+r)}{(1-r)}$  where  $r$  is the correlation coefficient.

TABLE 6.—Intercorrelations (upper right-hand section) and corresponding z values (lower left-hand section) of 20 measurements on a sample of 32,165 boys aged 4 to 14

Measurement	Age	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth at armseye	Waist girth	Hip girth	Neck-base girth	Armseye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth	
Age	1.467																				
Waist height		0.899																			
Hip height			0.900																		
Weight				0.822																	
Stature					0.897																
Cervicale height						0.898															
Tibiale height							0.879														
Bitrochanteric diameter								0.826													
Chest girth at armseye									0.813												
Waist girth										0.690											
Hip girth											0.807										
Neck-base girth												0.760									
Armseye girth													0.823								
Upper-arm girth														0.688							
Total posterior arm length															0.887						
Thigh girth																0.736					
Maximum calf girth																	0.785				
Knee girth																		0.812			
Total crotch length																			0.799		
Vertical trunk girth																				0.848	

<sup>1</sup> Overlapping measurements (see foot note 12).

TABLE 7.—Intercorrelations (upper right-hand section) and corresponding z values (lower left-hand section) of 20 measurements on a sample of 31,919 girls aged 4 to 14

Measurement	Age	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth at armseye	Waist girth	Hip girth	Neck-base girth	Armseye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth	
Age	1.557																				
Waist height		0.915																			
Hip height			0.908																		
Weight				0.843																	
Stature					0.921																
Cervicale height						0.921															
Tibiale height							0.890														
Bitrochanteric diameter								0.857													
Chest girth at armseye									0.826												
Waist girth										0.673											
Hip girth											0.840										
Neck-base girth												0.799									
Armseye girth													0.823								
Upper-arm girth														0.692							
Total posterior arm length															0.909						
Thigh girth																0.765					
Maximum calf girth																	0.800				
Knee girth																		0.823			
Total crotch length																			0.826		
Vertical trunk girth																				0.885	

<sup>1</sup> Overlapping measurements (see foot-note 12).

As shown by tables 6 and 7, the correlations between most measurements are high.<sup>12</sup> However, certain well-defined patterns are evident. Weight is highly correlated with all measurements. With the exception of

<sup>12</sup> The wide range of the ages of the children introduces wide variations in the measurements and consequently large correlations may be misleading if these variations are not taken into account. Thus a correlation of 0.67 between stature and hip girth for boys aged 10 years, may account for the same percentage of variation of either of these measurements as a correlation of 0.90 for boys aged 4 to 14. Moreover, the correlations presented in these and subsequent tables were obtained on the assumption of linear relationships among the measurements. Because of the wide age range, this assumption is not valid for many of the measurements in the set. If curvilinearity were taken into account, the correlations could be expected to be even larger than those given in these tables.

It will also be noted that the correlations that arose from overlapping measurements such as tibiale height, hip height, waist height, cervicale height, and stature may be expected to be fairly large if for no other reason than that they measure a common part of the body. They are obviously different from zero regardless of sampling fluctuations. Consequently, any test of significance based on the hypothesis of zero correlation in the population is a meaningless procedure.

a few small girths, age is least correlated with all of the other measurements. Linear measurements such as stature and arm length are more highly correlated among themselves than with the girths. Weight and girths, such as those of the hip and chest, are more highly correlated among themselves than with the linear measurements.

The first 2 of the above conclusions in the main, were corroborated by a component analysis. The principal components (3, 5) were obtained for the 20 measurements under consideration for each of 3 samples and each sex. In each case the first principal component accounts for approximately 89 percent of the variations of the 20 measurements. It was found that weight is most highly correlated with the first principal component for the



samples of boys and girls. Age is least correlated for the samples of boys and among the least for the samples of girls. The ranking of the measurements according to the size of their correlation with the first principal component was the same for each of the three samples analyzed. Table 8 gives the correlation of the first principal component with the 20 measurements, calculated on the combined sample of 32,165 boys and 31,919 girls.

The last three conclusions stated above were further examined by a study of partial correlations. These were obtained by holding age, some linear measurements, and some girths constant in turn. Tables 9 to 13, inclusive, give the partial correlations together with the  $z$  values when age, stature, arm length, hip girth, and chest girth are held constant.<sup>13</sup> Some of the information contained in these tables may be summarized as follows:

<sup>13</sup>The quantity  $z$  given in tables 9-13 may be considered as normally distributed with a standard error equal to  $\sqrt{1/N-p-3}$  (where  $p$  is the number of variates eliminated). The probability that the absolute value of  $z$  will exceed  $t$  times the standard error may be obtained from normal probability tables. This test is not applicable to correlations marked with a footnote.

TABLE 8.—Correlation with the first principal component of each of 20 measurements on a sample of 32,165 boys and 31,919 girls aged 4 to 14

Measurement	Correlations with first principal component (boys)	Measurement	Correlations with first principal component (girls)
Weight	0.9829	Weight	0.9824
Hip girth	.9750	Hip girth	.9777
Vertical trunk girth	.9734	Vertical trunk girth	.9755
Bitrochanteric diameter	.9687	Bitrochanteric diameter	.9697
Stature	.9658	Cervicale height	.9615
Cervicale height	.9653	Stature	.9604
Knee girth	.9606	Chest girth at armscye	.9585
Chest girth at armscye	.9601	Knee girth	.9577
Waist height	.9599	Waist height	.9575
Armscye girth	.9547	Total posterior arm length	.9505
Total posterior arm length	.9545	Armscye girth	.9476
Hip height	.9493	Total crotch length	.9475
Maximum calf girth	.9468	Maximum calf girth	.9431
Total crotch length	.9446	Hip height	.9402
Tibiale height	.9435	Thigh girth	.9389
Thigh girth	.9284	Tibiale height	.9337
Neck-base girth	.9018	Neck-base girth	.9056
Upper-arm girth	.8926	Age	.8971
Waist girth	.8882	Upper-arm girth	.8852
Age	.8766	Waist girth	.8687

TABLE 9.—Partial correlations (upper right-hand section) with corresponding  $z$  values (lower left-hand section) when age is held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14, for 19 measurements

Measurement	BOYS																		
	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth at armscye	Waist girth	Hip girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Waist height		0.954	0.705	1.050	1.054	0.893	0.675	0.606	0.495	0.660	0.554	0.609	0.464	0.875	0.547	0.585	0.669	0.705	0.694
Hip height	1.1875		.651	1.921	1.926	1.901	.615	.566	.455	.601	.510	.566	.413	.869	.492	.537	.627	.589	.662
Weight	.877	.777		.753	.751	.644	.880	.874	.816	.926	.712	.825	.838	.702	.861	.859	.842	.806	.876
Stature	1.1832	1.1596	.980		1.980	1.872	.711	.646	.511	.692	.610	.650	.496	.870	.561	.624	.693	.699	.811
Cervicale height	1.1875	1.1630	.975	1.298		1.875	.711	.642	.513	.691	.589	.646	.494	.873	.562	.617	.689	.695	.805
Tibiale height	1.1437	1.1478	.765	1.341	1.354		.609	.561	.464	.597	.502	.551	.421	.820	.493	.550	.669	.572	.645
Bitrochanteric diameter	.820	.717	1.376	.889	.889	.707		.790	.747	.920	.637	.754	.763	.670	.821	.801	.803	.751	.796
Chest girth at armscye	.703	.642	1.350	.768	.762	.634	1.071		.804	.845	.689	.788	.803	.632	.793	.774	.760	.709	.784
Waist girth	.543	.491	1.145	.564	.567	.502	.966	1.110		.824	.600	.700	.771	.510	.799	.733	.730	.655	.689
Hip girth	.793	.695	1.630	.852	.850	.689	1.589	1.238	1.169		.665	.798	.856	.652	.925	.857	.859	.803	.830
Neck-base girth	.624	.563	.891	.709	.676	.552	.753	.846	.693	.802		.684	.610	.570	.955	.619	.614	.618	.698
Armscye girth	.707	.642	1.172	.775	.768	.620	.982	1.066	.867	1.093	.837		.783	.639	.751	.727	.723	.684	.771
Upper-arm girth	.502	.439	1.214	.544	.541	.449	1.003	1.107	1.023	1.278	.709	1.053		.481	.874	.801	.752	.676	.705
Total posterior arm length	1.354	1.329	.871	1.333	1.346	1.157	.811	.745	.563	.779	.648	.757	.524		.538	.575	.649	.624	.701
Thigh girth	.614	.539	1.297	.634	.636	.540	1.160	1.080	1.096	1.623	.685	.975	1.350	.601		.842	.808	.723	.730
Maximum calf girth	.670	.600	1.290	.732	.720	.618	1.101	1.080	.935	1.282	.723	9.22	1.101	.655	1.228		.827	.710	.749
Knee girth	.809	.736	1.228	.854	.846	.809	1.107	.996	.929	1.290	.715	.914	.978	.774	1.121	1.179		.724	.761
Total crotch length	.877	.676	1.116	.865	.858	.651	.975	.885	.784	1.107	.722	.837	.822	.732	.914	.887	.916		1.831
Vertical trunk girth	.856	.796	1.358	1.130	1.113	.767	1.088	1.056	.846	1.187	.863	1.023	.877	.869	.929	.971	.999	1.191	

Measurement	GIRLS																		
	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth at armscye	Waist girth	Hip girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Waist height		0.935	0.622	1.039	1.043	1.086	0.579	0.524	0.435	0.575	0.497	0.539	0.405	0.854	0.491	0.506	0.596	0.640	0.678
Hip height	1.1697		.526	1.892	1.895	1.869	.477	.450	.375	.477	.426	.458	.318	.836	.406	.427	.524	.476	.559
Weight	.728	.585		.660	.667	.521	.882	.874	.808	.942	.666	.802	.840	.612	.895	.847	.833	.792	.855
Stature	1.1730	1.1432	.793		1.974	1.834	.625	.549	.429	.607	.498	.559	.408	.841	.499	.534	.608	.610	.753
Cervicale height	1.1765	1.1447	.805	1.265		1.833	.631	.553	.439	.612	.514	.562	.416	.844	.508	.534	.607	.616	.753
Tibiale height	1.1325	1.1329	.578	1.201	1.198		.484	.445	.382	.479	.423	.452	.333	.778	.416	.444	.561	.464	.542
Bitrochanteric diameter	.661	.519	1.385	.733	.743	.528		.787	.720	.926	.583	.721	.750	.573	.829	.757	.770	.729	.788
Chest girth at armscye	.582	.485	1.350	.617	.623	.478	1.064		.813	.846	.624	.773	.800	.538	.818	.755	.743	.694	.750
Waist girth	.466	.394	1.121	.459	.471	.402	.908	1.136		.800	.560	.704	.777	.437	.801	.713	.715	.646	.660
Hip girth	.655	.519	1.756	.704	.712	.522	1.630	1.242	1.099		.625	.779	.846	.565	.929	.837	.837	.796	.826
Neck-base girth	.545	.455	.804	.547	.568	.451	.667	.732	.633	.733		.597	.558	.491	.588	.574	.585	.566	.622
Armscye girth	.603	.495	1.104	.631	.636	.487	.910	1.028	.875	1.043	.689		.769	.556	.757	.696	.701	.665	.726
Upper-arm girth	.430	.329	1.221	.433	.443	.346	.973	1.099	1.038	1.242	.630	1.018		.407	.880	.796	.756	.683	.683
Total posterior arm length	1.271	1.208	.712	1.225	1.235	1.040	.652	.601	.469	.640	.537	.627	.432		.478	.489	.570	.531	.624
Thigh girth	.537	.431	1.447	.548	.560	.443	1.185	1.151	1.101	1.651	.675	.989	1.376	.520		.841	.818	.745	.745
Maximum calf girth	.557	.456	1.245	.596	.596	.477	.989	.985	.893	1.211	.654	.860	1.088	.535	1.225		.817	.685	.715
Knee girth	.687	.582	1.198	.706	.704	.634	1.020	.957	.897	1.211	.670	.869	.987	.648	1.151	1.148		.706	.728
Total crotch length	.758	.518	1.077	.709	.719	.502	.927	.856	.768	1.088	.642	.802	.835	.592	.962	.839	.879		1.815
Vertical trunk girth	.825	.631	1.274	.980	.980	.607	1.066	.973	.793	1.175	.728	.920	.835	.732	.962	.897	.925	1.142	

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 10.—Partial correlations (upper right-hand section) with corresponding z values (lower left-hand section) when stature is held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14, for 19 measurements

Measurement	BOYS																		
	Age	Waist height	Hip height	Weight	Cervicale height	Tibiale height	Birochan-teric diam-eter	Chest girth at armsyce	Waist girth	Hip girth	Neck-base girth	Armsyce girth	Upper-arm girth	Total pos-terior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Age	0.168	0.166	0.214	-0.058	0.112	0.061	0.011	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Waist height		0.168	0.214	-0.058	0.112	0.061	0.011	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Hip height			0.166	-0.058	0.112	0.061	0.011	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Weight				0.166	0.112	0.061	0.011	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Cervicale height					0.166	0.112	0.061	0.011	0.049	-0.044	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Tibiale height						0.166	0.011	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Birochan-teric diam-eter							0.166	0.049	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Chest girth at armsyce								0.166	-0.044	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Waist girth									0.166	-0.026	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Hip girth										0.166	-0.041	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Neck-base girth											0.166	0.072	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Armsyce girth												0.166	-0.031	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Upper-arm girth													0.166	0.138	-0.029	0.000	-0.011	-0.057	-0.035
Total pos-terior arm length														0.166	-0.029	0.000	-0.011	-0.057	-0.035
Thigh girth															0.166	0.000	-0.011	-0.057	-0.035
Maximum calf girth																0.166	-0.011	-0.057	-0.035
Knee girth																	0.166	-0.057	-0.035
Total crotch length																		0.166	-0.035
Vertical trunk girth																			0.166

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 11.—Partial correlations (upper right-hand section) with corresponding z values (lower left-hand section) when total posterior arm length is held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14, for 19 measurements

Measurement	BOYS																		
	Age	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Birochan-teric diameter	Chest girth at armsyce	Waist girth	Hip girth	Neck-base girth	Armsyce girth	Upper-arm girth	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Age	0.343	0.330	0.344	0.060	0.318	0.325	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Waist height		0.343	0.344	0.060	0.318	0.325	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Hip height			0.330	0.060	0.318	0.325	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Weight				0.343	0.318	0.325	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Stature					0.343	0.325	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Cervicale height						0.343	0.206	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Tibiale height							0.343	0.107	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Birochan-teric diameter								0.343	0.107	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Chest girth at armsyce									0.343	-0.016	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Waist girth										0.343	0.066	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Hip girth											0.343	0.041	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Neck-base girth												0.343	0.129	0.012	0.028	0.090	0.087	0.076	0.162
Armsyce girth													0.343	0.012	0.028	0.090	0.087	0.076	0.162
Upper-arm girth														0.343	0.028	0.090	0.087	0.076	0.162
Thigh girth															0.343	0.090	0.087	0.076	0.162
Maximum calf girth																0.343	0.087	0.076	0.162
Knee girth																	0.343	0.076	0.162
Total crotch length																		0.343	0.162
Vertical trunk girth																			0.343

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 12.—Partial correlations (upper right-hand section) with corresponding z values (lower left-hand section) when hip girth is held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14, for 19 measurements

BOYS

Measurement	Age	Waist height	Hip height	Weight	Stature	Cervical height	Tibiale height	Bitrochanteric diameter	Chest girth at armscye	Waist girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Age	0.813	0.671	0.678	0.272	0.666	0.669	0.605	0.299	0.261	-0.176	0.202	0.331	-0.244	0.628	-0.264	0.112	0.246	0.226	0.446
Waist height	0.825	1.959	1.961	0.418	1.950	1.954	1.894	0.364	0.261	-0.201	0.285	0.349	-0.351	0.871	-0.337	0.112	0.355	0.434	0.591
Hip height	0.279	1.445	1.430	0.405	1.931	1.937	1.904	0.342	0.274	-0.184	0.270	0.349	-0.341	0.876	-0.327	0.115	0.359	0.313	0.544
Weight	0.804	1.832	1.666	0.518	1.946	1.979	1.893	0.258	0.494	-0.186	0.377	0.431	-0.153	0.429	-0.039	0.354	0.291	0.324	0.561
Stature	0.698	1.187	1.173	0.514	2.273	2.273	1.876	0.388	0.288	-0.224	0.338	0.375	-0.350	0.622	-0.383	0.136	0.357	0.393	0.679
Cervicale height	0.809	1.875	1.713	0.514	2.273	2.273	1.876	0.388	0.288	-0.224	0.338	0.375	-0.350	0.622	-0.383	0.136	0.357	0.393	0.679
Tibiale height	0.267	0.267	0.281	0.541	2.296	2.291	0.264	0.136	0.207	-0.098	0.142	0.176	-0.182	0.364	-0.266	0.094	0.131	0.118	0.261
Bitrochanteric diameter	0.308	0.382	0.356	0.264	0.407	0.409	0.337	0.258	0.258	-0.135	0.292	0.355	0.409	0.207	0.314	0.103	0.203	0.180	0.152
Chest girth at armscye	0.267	0.267	0.281	0.541	2.296	2.291	0.264	0.136	0.207	-0.098	0.142	0.176	-0.182	0.364	-0.266	0.094	0.131	0.118	0.261
Waist girth	-0.178	-0.204	-0.186	0.388	-0.228	-0.222	-0.155	-0.098	0.301	0.084	0.084	0.056	0.257	-0.158	-0.211	0.071	0.028	-0.056	-0.063
Neck-base girth	0.205	0.293	0.277	0.397	0.352	0.320	0.265	0.143	0.371	0.084	0.084	0.056	0.257	-0.158	-0.211	0.071	0.028	-0.056	-0.063
Armscye girth	0.344	0.364	0.364	0.461	0.398	0.393	0.327	0.178	0.434	0.056	0.402	0.216	-0.213	0.399	-0.037	0.167	0.192	0.186	0.421
Upper-arm girth	-0.249	-0.367	-0.355	0.154	-0.365	-0.367	-0.327	-0.184	-0.210	0.263	0.050	0.216	-0.302	-0.456	-0.217	-0.002	-0.087	-0.123	-0.123
Total posterior arm length	0.738	1.337	1.338	0.459	1.301	1.317	1.151	0.382	0.325	-0.159	0.321	0.423	-0.312	0.399	-0.337	0.103	0.326	0.310	0.543
Thigh girth	-0.270	-0.351	-0.340	0.039	-0.401	-0.398	-0.318	-0.131	-0.013	0.214	-0.120	-0.037	0.492	-0.351	-0.337	0.211	0.000	-0.138	-0.268
Maximum calf girth	0.113	0.113	0.116	0.370	0.137	0.126	0.141	0.094	0.206	0.071	0.147	0.169	-0.221	0.103	0.214	0.375	0.358	0.096	0.168
Knee girth	0.251	0.371	0.376	0.300	0.373	0.364	0.475	0.132	0.182	0.028	0.155	0.194	-0.002	0.338	0.000	0.375	0.358	0.096	0.168
Total crotch length	0.230	0.465	0.324	0.336	0.415	0.407	0.294	0.119	0.153	-0.056	0.229	0.188	-0.087	0.321	-0.139	0.096	0.162	0.153	0.533
Vertical trunk girth	0.480	0.679	0.610	0.634	0.846	0.827	0.559	0.267	0.375	-0.063	0.421	0.449	-0.124	0.628	-0.279	0.170	0.263	1.594	1.594

GIRLS

Age	0.818	0.674	0.660	0.172	0.696	0.694	0.598	0.310	0.158	-0.284	0.167	0.204	-0.336	0.651	-0.343	0.037	0.151	0.202	0.511
Waist height	0.793	1.959	1.955	0.326	1.950	1.954	1.892	0.311	0.168	-0.229	0.188	0.266	-0.359	0.878	-0.330	0.064	0.288	0.402	0.623
Hip height	1.174	1.886	1.666	0.304	1.925	1.927	1.895	0.279	0.177	-0.197	0.296	0.249	-0.352	0.875	-0.308	0.067	0.291	0.266	0.552
Weight	0.860	1.832	1.623	0.368	1.931	1.937	1.864	0.258	0.446	-0.209	0.323	0.346	-0.166	0.326	-0.092	0.322	0.262	0.237	0.431
Stature	1.187	1.637	1.637	0.370	2.273	2.273	1.864	0.357	0.167	-0.280	0.302	0.262	-0.403	0.867	-0.389	0.068	0.267	0.326	0.702
Cervicale height	0.690	1.875	1.637	0.370	2.273	2.273	1.864	0.357	0.167	-0.280	0.302	0.262	-0.403	0.867	-0.389	0.068	0.267	0.326	0.702
Tibiale height	0.321	0.322	0.287	0.126	0.373	0.371	0.282	0.165	0.274	0.116	0.260	0.402	0.869	-0.385	0.058	0.058	0.256	0.256	0.695
Bitrochanteric diameter	0.159	0.170	0.179	0.480	0.169	0.167	0.161	0.063	0.171	0.088	0.059	0.231	-0.319	0.815	-0.275	0.093	0.353	0.242	0.508
Chest girth at armscye	-0.292	-0.233	-0.200	0.212	-0.288	-0.281	-0.175	-0.173	0.376	0.051	0.051	0.144	-0.207	0.333	0.113	0.089	-0.032	-0.146	-0.146
Waist girth	0.169	0.329	0.305	0.335	0.312	0.327	0.293	0.088	0.263	0.051	0.264	-0.017	0.316	-0.058	0.126	0.176	0.188	0.325	0.325
Neck-base girth	0.207	0.273	0.254	0.361	0.268	0.266	0.238	0.059	0.378	0.145	-0.270	0.234	-0.234	0.299	0.065	0.135	0.168	0.154	0.301
Armscye girth	-0.350	-0.376	-0.368	0.168	-0.427	-0.426	-0.331	-0.262	0.227	0.400	-0.017	0.238	-0.336	-0.538	0.273	0.103	-0.040	-0.215	-0.215
Upper-arm girth	-0.777	-1.367	-1.354	0.338	-1.321	-1.329	-1.142	-0.326	0.207	-0.210	0.327	0.308	-0.350	-0.332	0.051	0.258	0.251	0.552	0.552
Total posterior arm length	-0.358	-0.343	-0.318	0.092	-0.411	-0.406	-0.282	-0.312	0.095	0.346	-0.058	0.065	-0.601	-0.345	-0.284	0.135	-0.044	-0.256	-0.256
Thigh girth	0.037	0.064	0.067	0.334	0.068	0.058	0.093	-0.072	0.165	0.118	0.127	0.136	-0.280	0.051	0.292	0.390	0.062	0.086	0.491
Maximum calf girth	0.152	0.296	0.300	0.268	0.274	0.262	0.369	0.023	0.143	0.089	0.178	0.170	0.103	0.264	0.136	0.412	0.358	0.146	0.177
Knee girth	0.205	0.426	0.273	0.242	0.338	0.340	0.247	0.030	0.192	0.032	0.190	0.155	-0.040	0.257	-0.044	0.062	0.147	0.147	0.491
Total crotch length	0.564	0.730	0.621	0.461	0.871	0.858	0.560	0.249	0.230	-0.147	0.337	0.311	-0.218	0.621	-0.265	0.086	0.179	1.537	1.537
Vertical trunk girth	0.564	0.730	0.621	0.461	0.871	0.858	0.560	0.249	0.230	-0.147	0.337	0.311	-0.218	0.621	-0.265	0.086	0.179	1.537	1.537

1 Overlapping measurements (see footnote 12, p. 30).

TABLE 13.—Partial correlations (upper right-hand section) with corresponding z values (lower left-hand section), when chest girth is held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14, for 19 measurements

BOYS

Measurement	Age	Waist height	Hip height	Weight	Stature	Cervical height	Tibiale height	Bitrochanteric diameter	Waist girth	Hip girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Age	0.795	0.661	0.669	0.258	0.653	0.656	0.596	0.323	-0.165	0.196	0.162	0.310	-0.168	0.616	-0.021	0.169	0.284	0.268	0.429
Waist height	0.809	1.972	1.962	0.499	1.955	1.958	1.900	0.500	-0.096	0.386	0.283	0.397	-0.146	0.878	-0.089	0.282	0.478	0.532	0.637
Hip height	0.264	0.548	0.487	0.452	1.934	1.939	1.909	0.449	-0.110	0.334	0.256	0.375	-0.175	0.881	0.050	0.252	0.452	0.411	0.574
Weight	0.781	1.886	1.689	0.604	1.941	1.941	1.879	0.258	0.330	0.339	0.496	0.496	-0.405	0.462	0.543	0.609	0.595	0.575	0.662
Stature	0.786	1.921	1.730	0.606	2.322	2.322	1.882	0.521	-0.112	0.397	0.303	0.417	-0.145	0.871	0.071	0.295	0.478	0.498	0.713
Cervicale height	0.687	1.187	1.187	0.522	2.322	2.322	1.882	0.521	-0.112	0.397	0.303	0.417	-0.145	0.871	0.071	0.295	0.478	0.498	0.713
Tibiale height	0.335	0.335	0.335	0.302	0.574	0.578	0.474	0.341	0.234	0.178	0.248	0.414	0.275	0.467	0.484	0.510	0.554	0.489	0.535
Bitrochanteric diameter	-0.167	-0.096	-0.111	0.343	-0.122	-0.113	-0.077	0.238	0.408	0.078	0.118	0.371	-0.097	0.444	0.259	0.245	0.149	0.071	0.071
Chest girth at armscye	0.199	0.407	0.347	0.937	0.412	0.420	0.351	0.040	0.433	0.078	0.239	0.436	0.505	0.341	0.762	0.612	0.644	0.562	0.530
Waist girth	0.163	0.291	0.262	0.353	0.343	0.313	0.255	0.253	0.078	0.244	0.347	0.099	0.099	0.285	0.105	0.208	0.227	0.283	0.382
Neck-base girth	0.321	0.420	0.349	0.544	0.447	0.444	0.364	0.440	0.119	0.467	0.362	0.331	0.412	0.312	0.333	0.371	0.347	0.477	0.477
Armscye girth	-0.170	-0.147	-0.177	0.430	-0.148	-0.146	0.149	0.282	0.390	0.556	0.099	0.344	-0.149	0.647	0.434	0.298	0.196	0.110	0.110
Upper-arm girth	0.719	1.367	1.380	0.500	1.325	1.337	1.175	0.506	-0.097	0.556	0.293	0.438	-0.150	0.647	0.434	0.298	0.196	0.110	0.110
Total posterior arm length	-0.021	-0.089	0.050	0.608	0.066	0.071	0.064	0.528	0.477	1.001	0.105	0.323	0.770	0.047	0.047	0.240	0.428	0.409	0.568
Thigh girth	0.171	0.290	0.258	0.707	0.312	0.304	0.282	0.563	0.265	0.712	0.211	0.346	0.465	0.245	0.661	0.597	0.489	0.388	0.394
Maximum calf girth	0.292	0.520	0.487	0.685	0.526	0.520	0.572	0.624	0.250	0.765	0.231	0.390	0.307	0.457	0.539	0.689	0.449	0.449	0.477
Knee girth	0.275	0.593	0.437	0.655	0.552	0.547	0.412	0.535	0.150	0.636	0.291	0.362	0.199	0.434	0.371	0.409	0.484	0.467	0.661
Total crotch length	0.459	0.753	0.654	0.796	0.908	0.893	0.613	0.597	0.071	0.590	0.402	0.519	0.111	0.645	-0.417	0.519	1.795	1.795	1.795
Vertical trunk girth	0.459	0.753	0.654	0.796	0.908	0.893	0.												

When age is used as a control measurement (i. e., held constant) the inclusion of a length, such as stature or arm length, in combination with age substantially reduces the residual variances of the other measurements. This can be seen from the high partial correlations of lengths with the other measurements when age is held constant (table 9). When either stature or arm length is used as a control, the inclusion of age will not significantly reduce the variation of the other measurements. This appears evident from tables 10 and 11, which show low correlations of age with every other measurement when stature or arm length is held constant.

Because these correlations are so small, the inference may be drawn that the contribution of age in the reduction of the residual variance will be small for all measurements after length has been eliminated. In other words, not only are lengths more highly correlated than age with all measurements considered, but, if a length such as stature or arm length is used as a basis for sizing garments, the further knowledge of a child's age will add very little in predicting his other measurements. On the other hand, if sizes are based on age, then the further knowledge of the child's height, say, may be of great significance.

When girths are used as control measurements (tables 12 and 13), the partial correlations between age and the girths (or weight) are smaller than the partial correlations between age and stature, or between age and arm length. Thus, if a child's hip girth is known, knowing also his age will not help to predict his other girths as much as it will to predict his lengths. However, when girths are held constant, the partial correlations of stature with the other measurements are higher than the partial correlation of age with other measurements. Thus, if a girth such as hip girth or chest girth is chosen as a control measurement, and if further accuracy is desired in predicting the other measurements, then either stature or length of arm would be a better choice than age.

If a length such as stature or arm length is used as a control, then the inclusion of another linear measurement will not much further reduce the variation of the girths. Conversely, the inclusion of a girth will not further reduce the variation of the linear measurements (tables 10 and 11). Thus, if height or arm length is used as a control, little knowledge is obtained by introducing another length as far as the girths are concerned, or by introducing a girth as far as the lengths are concerned. However, when a length is held constant, the correlation between two girths is fairly large, as can be seen from tables 10 and 11. This is especially true for the correlation of hip girth or weight with the other girths. It follows, therefore, that if sizing were based on a length, then the inclusion of weight or a girth would probably result in a further reduction of the residual variances in girths.

If a girth, such as hip girth, is used as a control the correlation between two linear measurements is larger than between a girth and a linear measurement. Thus, for a constant girth, the inclusion of a measurement such as stature would tend to reduce the residual variances of lengths more than of girths.

The percentages given in tables 14 to 17 inclusive, illustrate more clearly one of these major findings; namely, if two measurements are chosen as controls, a length and a girth should be selected in preference to a combination of age with any other measurement of the set. In order to obtain the percentages given in these tables, the regression equations in standard units were first calculated for each of the measurements on each of eight combinations indicated on pages 35 and 36. The percentage of each of these standard coefficients to the sum of the two coefficients in each regression equation was then calculated.

TABLE 14.—Percentage contribution of age in predicting body measurements in contrast to the contribution of stature or of hip girth, based on a sample of 32,165 boys and 31,919 girls

Measurement <sup>1</sup>	Boys				Girls			
	Age—stature		Age—hip girth		Age—stature		Age—hip girth	
	Age	Stature	Age	Hip girth	Age	Stature	Age	Hip girth
Waist height.....	5.2	94.8	50.7	49.3	2.2	97.8	56.5	43.5
Hip height.....	8.5	91.5	55.1	44.9	2.4	97.6	61.8	38.2
Weight.....	4.8	95.2	10.4	89.6	.4	99.6	5.8	94.2
Stature.....			48.2	51.8			55.9	44.1
Cervicale height.....	2.2	97.8	48.5	51.5	2.2	97.8	55.3	44.7
Tibiale height.....	3.3	96.7	50.3	49.7	.8	99.2	57.7	42.3
Bitrochanteric diameter.....	1.1	98.9	11.8	88.2	10.4	89.6	11.6	88.4
Chest girth at armscye.....	5.5	94.5	14.6	85.4	10.9	89.1	9.1	90.9
Waist girth.....	6.9	93.1	11.0	89.0	8.5	91.5	18.3	81.7
Hip girth.....	2.7	97.3			7.0	93.0		
Neck-base girth.....	5.0	95.0	18.8	81.2	10.7	89.3	23.8	76.2
Armscye girth.....	7.8	92.2	20.9	79.1	8.3	91.7	14.3	85.7
Upper-arm girth.....	5.1	94.9	13.2	86.8	.5	99.5	18.5	81.5
Total posterior arm length.....	7.3	92.7	48.4	51.6	8.3	91.7	55.6	44.4
Thigh girth.....	4.1	95.9	10.1	89.9	.8	99.2	12.8	87.2
Maximum calf girth.....	1.1	99.9	6.4	93.6	5.1	94.9	2.3	97.7
Knee girth.....	1.1	98.9	13.1	86.9	1.0	99.0	9.0	91.0
Total crotch length.....	5.5	94.5	14.7	85.3	1.4	98.6	13.5	86.5
Vertical trunk girth.....	2.4	97.6	25.1	74.9	5.7	94.3	28.8	71.2

<sup>1</sup> Note that the measurements waist height, hip height, cervicale height, and tibiale height are parts of stature.

TABLE 15.—Percentage contribution of age in predicting body measurements in contrast to the contribution of chest girth or of total posterior arm length, based on a sample of 32,165 boys and 31,919 girls

Measurement <sup>1</sup>	Boys				Girls			
	Age—chest girth		Age—total arm length		Age—chest girth		Age—total arm length	
	Age	Chest girth	Age	Total arm length	Age	Chest girth	Age	Total arm length
Waist height.....	53.6	46.4	16.3	83.7	61.7	38.3	16.6	83.4
Hip height.....	56.7	43.3	17.3	82.7	65.3	34.7	14.5	85.5
Weight.....	12.9	87.1	5.7	94.3	15.5	84.5	13.6	86.4
Stature.....	50.5	49.5	16.0	84.0	61.5	38.5	20.7	79.3
Cervicale height.....	51.0	49.0	16.1	83.9	61.1	38.9	20.3	79.7
Tibiale height.....	52.3	47.7	12.8	87.2	62.1	37.9	12.0	88.0
Bitrochanteric diameter.....	20.9	79.1	10.6	89.4	26.6	73.4	23.0	77.0
Chest girth at armscye.....			11.7	88.3			18.6	81.4
Waist girth.....	11.0	89.0	2.6	97.4	16.4	83.6	3.9	96.1
Hip girth.....	11.3	88.7	7.2	92.8	17.1	82.9	19.1	80.9
Neck-base girth.....	14.8	85.2	5.5	94.5	27.2	72.8	17.9	82.1
Armscye girth.....	20.3	79.7	13.5	86.5	18.6	81.4	15.0	85.0
Upper-arm girth.....	11.2	88.8	2.1	97.9	13.2	86.8	6.9	93.1
Total posterior arm length.....	48.9	51.1			59.3	40.7		
Thigh girth.....	1.6	98.4	4.2	95.8	.8	99.2	11.2	88.8
Maximum calf girth.....	12.3	87.7	11.4	88.6	14.4	85.6	18.5	81.5
Knee girth.....	20.2	79.8	9.3	90.7	21.4	78.6	13.2	86.8
Total crotch length.....	21.7	78.3	8.7	91.3	26.6	73.4	19.4	80.6
Vertical trunk girth.....	27.3	72.7	14.3	85.7	37.4	62.6	26.4	73.6

<sup>1</sup> Note that the measurements waist height, hip height, cervicale height, and tibiale height are parts of stature.

TABLE 16.—Percentage contribution of stature in predicting body measurements in contrast to the contribution of chest girth or of hip girth, based on a sample of 32,165 boys and 31,919 girls

Measurement <sup>1</sup>	Boys				Girls			
	Stature—chest girth		Stature—hip girth		Stature—chest girth		Stature—hip girth	
	Stature	Chest girth	Stature	Hip girth	Stature	Chest girth	Stature	Hip girth
Waist height	99.3	0.7	99.8	0.2	98.9	1.1	99.3	0.7
Hip height	96.9	3.1	95.0	5.0	96.2	3.8	93.1	6.9
Weight	34.9	65.1	25.0	75.0	30.3	69.7	15.1	84.9
Cervicale height	98.7	1.3	98.2	1.8	98.0	2.0	97.3	2.7
Tibiale height	99.9	.1	99.0	1.0	98.6	1.4	96.6	3.4
Bitrochanteric diameter	43.7	56.3	21.1	78.9	40.6	59.4	17.0	83.0
Chest girth at armseye			22.5	77.5			12.2	87.8
Waist girth	10.5	89.5	16.5	83.5	15.9	84.1	20.6	79.4
Hip girth	29.4	70.6			28.4	71.6		
Neck-base girth	38.6	61.4	43.4	56.6	41.3	58.7	37.3	62.7
Armseye girth	35.9	64.1	33.4	66.6	29.9	70.1	23.2	76.8
Upper-arm girth	12.4	87.6	20.8	79.2	14.1	85.9	23.3	76.7
Total posterior arm length	90.0	10.0	92.6	7.4	91.3	8.7	92.9	7.1
Thigh girth	6.6	93.4	16.9	83.1	5.4	94.6	16.4	83.6
Maximum calf girth	28.6	71.4	10.7	89.3	25.7	74.3	5.4	94.6
Knee girth	44.5	55.5	26.4	73.6	38.9	61.1	20.1	79.9
Total crotch length	52.3	47.7	35.2	64.8	46.4	53.6	27.4	72.6
Vertical trunk girth	59.2	40.8	53.6	46.4	59.9	40.1	49.7	50.3

<sup>1</sup> Note that the measurements waist height, hip height, cervicale height, and tibiale height are parts of stature.

TABLE 17.—Percentage contribution of chest girth in predicting body measurements in contrast to the contribution of total posterior arm length or of hip girth, based on a sample of 32,165 boys and 31,919 girls

Measurement <sup>1</sup>	Boys				Girls			
	Chest girth—total arm length		Hip girth—chest girth		Chest girth—total arm length		Hip girth—chest girth	
	Chest girth	Total arm length	Hip girth	Chest girth	Chest girth	Total arm length	Hip girth	Chest girth
Waist height	8.5	91.5	39.2	60.8	8.6	91.4	27.2	72.8
Hip height	4.0	96.0	44.5	55.5	1.9	98.1	32.4	67.6
Weight	70.6	29.4	34.5	65.5	73.8	26.2	27.1	72.9
Stature	13.8	86.2	41.1	58.9	11.9	88.1	26.0	74.0
Cervicale height	13.1	86.9	11.9	88.1	12.2	87.8	25.4	74.6
Tibiale height	7.3	92.7	42.8	57.2	4.6	95.4	29.9	70.1
Bitrochanteric diameter	61.2	38.8	9.9	90.1	64.4	35.6	4.3	95.7
Chest girth at armseye								
Waist girth	91.3	8.7	40.6	59.4	86.2	13.8	60.0	40.0
Hip girth	75.0	25.0			75.4	24.6		
Neck-base girth	67.0	33.0	60.7	39.3	59.8	40.2	45.7	54.3
Armseye girth	65.4	34.6	48.1	51.9	70.2	29.8	45.4	54.6
Upper-arm girth	87.7	12.3	26.6	73.4	86.9	13.1	32.4	67.6
Total posterior arm length			47.7	52.3			33.6	66.4
Thigh girth	95.3	4.7	1.1	98.9	95.8	4.2	8.2	91.8
Maximum calf girth	77.6	22.4	21.1	78.9	78.9	21.1	18.6	81.4
Knee girth	61.1	38.9	17.8	82.2	64.8	35.2	15.3	84.7
Total crotch length	57.9	42.1	18.5	81.5	61.8	38.2	11.2	88.8
Vertical trunk girth	53.6	46.4	38.0	62.0	51.1	48.9	23.6	76.4

<sup>1</sup> Note that the measurements waist height, hip height, cervicale height, and tibiale height are parts of stature.

It may be asked at this point whether the above comparisons are significant; that is, whether it is likely that the differences between the sets of correlations studied could have arisen by chance alone. Unfortunately, comprehensive tests of significance for sets of nonindependent correlations have not been developed. However, there is enough evidence to indicate that the results obtained are statistically significant. For example, the analyses of the data show essentially the same relationships between the sets of partial correlations for both boys and girls. In view of the large size

of the sample it is unlikely that these results are chance occurrences. Rough statistical tests also indicated the significance of the results.<sup>14</sup>

Up to this point the efficacy of various measurements as control variates was studied, mainly from the standpoint of partial correlations. In addition to this, a more general analysis was made, which consisted of comparisons between residual generalized variances.<sup>15</sup> The aim of this analysis was to determine the control measurement or measurements that lead to the smallest residual generalized variance.

For example, the residual generalized variances were calculated for the measurements—chest girth, hip girth, total posterior arm length, and vertical trunk girth—holding stature and age constant in turn. The results obtained on the sample of boys are 9,619 for the residual generalized variance when age is held constant, and 1,605 when stature is held constant. The corresponding values for the sample of girls are 11,564 when age is held constant—2,342 when stature is held constant. Thus, for both samples, the unexplained variation in the 4 measurements when age is used as a control is much greater than the unexplained variation when stature is used as a control. A statistical test indicates that these results are significant.<sup>16</sup>

To summarize: Measurements such as stature, hip girth, chest girth, or length of arm appear to control the variations of the other measurements better than does age. If, after selecting a length, such as stature or length of arm, further accuracy is required in predicting girths, another girth rather than another length should be selected. Conversely, if a girth is chosen, such as hip girth or chest girth, and further accuracy is required in predicting linear measurements, a linear measurement should be chosen rather than another girth.

## Analyses of Combinations of Measurements as Possible Controls

In the previous section it has been shown that, in general, variations in linear measurements are best controlled by linear measurements, and variations in girth measurements are best controlled by girths. Therefore, it would appear reasonable to assume that combinations of linear measurements and girths would best control the variations of all the measurements of the set. Which particular combination of lengths and girths to choose was decided on the basis of both practical and statistical considerations.

<sup>14</sup> It can be shown that when the correlations are converted into  $z$  values the standard error of the difference between any two  $z$ 's cannot exceed  $\frac{2}{\sqrt{N-p-3}}$  where  $p$  is the

number of variates eliminated and  $N$  is the number in the sample. For the problem on hand this quantity is 0.0115 for the sample of boys and 0.0120 for the sample of girls. The differences between most of the  $z$ 's considered are many times larger than the above upper limits for the standard errors.

<sup>15</sup> For a discussion of the residual generalized variance, see p. 133. The variance of the sample generalized variance ( $V$ ), when the sample is large, is approximately equal to the square of the population generalized variance times the quantity  $2p/n$  where  $n$  is the number of degrees of freedom and  $p$  the number of variables. The variance of  $\log_e V$  is approximately equal to  $2p/n$  and is independent of population parameters. Moreover, it is easy to show that the variance of the difference between any two variates cannot exceed twice the sum of the variances of each variate separately. Hence, one can then take  $8p/n$  as an upper limit for the variance of the difference between the natural logarithms of two generalized variances.

Application of the above approximations to the  $\log_e$  of the ratio of the residual generalized variance when age is held constant, to the residual generalized variance when height is held constant, is more than 57 times the upper limit of its standard error in the case of boys and 49 times in the case of girls. The logarithms of the above ratios can be shown by Tchebycheff's well-known inequality to be significantly different from zero.

Practical considerations led to the conclusion that, if possible, no more than two measurements should be used as controls. These measurements, moreover, should have large ranges and be such as could be easily taken on a child.

The statistical considerations that led to the choice of a combination of control measurements were based, in a large part, on a study of multiple regressions. This study was performed on each of the 3 samples separately and on each sex. Eight measurements were selected. Regression equations and multiple correlations for each of 19 measurements were calculated on the 28 possible combinations of 2, and 56 combinations of 3 of these 8 measurements. The 8 variables chosen were: Age, waist height, weight, stature, hip girth, chest girth, total posterior arm length, and vertical trunk girth.

As in the previous section, the main emphasis in the analyses of multiple regressions was placed on the relative reduction in the variations of measurements. To this end, the squares of the multiple correlations (see appendix, p. 134) were calculated for each of the 19 measurements, with the 28 possible combinations of 2 of the selected 8 measurements. These are given in table 18. A selection of the squares of the multiple correlations of each of the 19 measurements with 6 of the 56 possible combinations of 3 measurements is given in table 19. These tables are based on a sample of 32,165 boys and 31,919 girls obtained by combining the three samples analyzed. It should be pointed out that though sampling fluctuations were observed in the sets of multiple correlations, the relative rank of these quantities remained the same from sample to sample.

TABLE 18.—Squares of the multiple correlations of each of 19 measurements on selected combinations of 2 measurements, based on a sample of 32,165 boys and 31,919 girls

Measurement	BOYS													
	Age— waist height	Age— weight	Age— stature	Age— chest girth at armsye	Age— hip girth	Age— total posterior arm length	Age— vertical trunk girth	Waist height— weight	Waist height— stature	Waist height— chest girth at armsye	Waist height— hip girth	Waist height— total posterior arm length	Waist height— vertical trunk girth	Weight— stature
Waist height		0.903	<sup>1</sup> 0.981	0.878	0.892	0.955	0.911							<sup>1</sup> 0.981
Hip height	<sup>1</sup> 0.983	.890	1.971	.871	.879	.953	.893	<sup>1</sup> 0.983	<sup>1</sup> 0.983	<sup>1</sup> 0.982	<sup>1</sup> 0.983	<sup>1</sup> 0.984	<sup>1</sup> 0.983	1.971
Weight	.837		.859	.923	.954	.836	.924		.860	.938	.959	.847	.927	
Stature	1.981	.916		.886	.899	.953	.933	1.984		1.982	1.982	1.982	1.987	
Cervicale height	1.983	.916	1.992	.886	.899	.954	.932	1.985	1.993	1.984	1.984	1.984	1.987	1.992
Tibiale height	1.954	.866	1.945	.844	.853	.925	.867	1.954	1.955	1.954	1.954	1.955	1.954	1.945
Bitrochanteric diameter	.827	.928	.842	.880	.951	.825	.883	.930	.842	.900	.953	.835	.889	.929
Chest girth at armsye	.786	.920	.802		.903	.797	.870	.919	.802		.903	.800	.870	.978
Waist girth	.604	.824	.613	.814	.832	.612	.724	.831	.612	.811	.833	.616	.723	.837
Hip girth	.803	.950	.818	.900		.799	.891	.950	.818	.911		.811	.893	.950
Neck-base girth	.707	.792	.735	.778	.764	.714	.783	.794	.737	.790	.774	.720	.785	.797
Armsye girth	.797	.897	.813	.878	.883	.809	.869	.895	.812	.886	.884	.811	.869	.895
Upper-arm girth	.586	.843	.602	.813	.859	.595	.735	.860	.602	.811	.868	.599	.737	.865
Total posterior arm length	.950	.892	.948	.872	.878	.892	.952	.953	.953	.953	.951		.951	.948
Thigh girth	.678	.882	.686	.830	.934	.674	.786	.885	.686	.831	.937	.685	.785	.889
Maximum calf girth	.747	.900	.766	.846	.898	.743	.831	.899	.766	.854	.898	.754	.833	.900
Knee girth	.812	.901	.823	.856	.911	.803	.857	.905	.824	.879	.917	.818	.866	.904
Total crotch length	.818	.873	.815	.820	.871	.779	1.888	.886	.820	.861	.890	.817	1.893	.880
Vertical trunk girth	.870	.935	.904	.892	.913	.857		.942	.908	.921	.929	.874		.950

Measurement	GIRLS													
	Age— waist height	Age— weight	Age— stature	Age— chest girth at armsye	Age— hip girth	Age— total posterior arm length	Age— vertical trunk girth	Waist height— weight	Waist height— stature	Waist height— chest girth at armsye	Waist height— hip girth	Waist height— total posterior arm length	Waist height— vertical trunk girth	Weight— stature
Waist height		0.900	<sup>1</sup> 0.981	0.882	0.891	0.956	0.912							<sup>1</sup> 0.981
Hip height	<sup>1</sup> 0.978	.872	1.964	.859	.864	.947	.879	<sup>1</sup> 0.979	<sup>1</sup> 0.978	<sup>1</sup> 0.978	<sup>1</sup> 0.979	<sup>1</sup> 0.979	<sup>1</sup> 0.980	1.965
Weight	.822		.837	.932	.967	.819	.922		.837	.942	.970	.829	.922	
Stature	1.982	.914		.894	.904	.956	.934	1.982		1.981	1.982	1.982	1.985	
Cervicale height	1.983	.915	1.992	.894	.905	.956	.934	1.984	1.993	1.983	1.983	1.983	1.986	1.992
Tibiale height	1.949	.848	1.936	.833	.840	.918	.853	1.949	1.949	1.949	1.949	1.950	1.950	1.937
Bitrochanteric diameter	.823	.941	.838	.899	.962	.821	.899	.939	.836	.908	.962	.826	.900	.940
Chest girth at armsye	.770	.925	.778		.910	.775	.861	.924	.777		.910	.778	.862	.924
Waist girth	.557	.810	.554	.815	.803	.558	.692	.811	.558	.807	.797	.564	.683	.820
Hip girth	.803	.967	.814	.917		.800	.907	.966	.814	.923		.808	.907	.966
Neck-base girth	.728	.799	.728	.779	.779	.726	.778	.802	.730	.793	.789	.732	.782	.800
Armsye girth	.771	.885	.778	.870	.873	.777	.847	.885	.778	.878	.877	.781	.849	.884
Upper-arm girth	.564	.847	.566	.813	.852	.565	.722	.857	.568	.810	.854	.571	.721	.866
Total posterior arm length	.953	.891	.949	.877	.882	.894	.953	.955	.954	.953	.953		.952	.949
Thigh girth	.685	.917	.688	.862	.943	.680	.816	.920	.690	.863	.942	.691	.813	.924
Maximum calf girth	.732	.898	.743	.845	.892	.726	.824	.898	.742	.851	.892	.735	.824	.898
Knee girth	.792	.901	.797	.856	.903	.782	.848	.904	.799	.875	.909	.797	.854	.903
Total crotch length	.812	.881	.800	.835	.883	.771	1.893	.892	.812	.868	.898	.812	1.895	.886
Vertical trunk girth	.882	.941	.906	.905	.931	.867		.947	.907	.928	.943	.881		.955

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 18.—Squares of the multiple correlations of each of 19 measurements on selected combinations of 2 measurements, based on a sample of 32,165 boys and 31,919 girls—Continued

BOYS

Measurement	Weight—chest girth at armseye	Weight—hip girth	Weight—total posterior arm length	Weight—vertical trunk girth	Stature—chest girth at armseye	Stature—hip girth	Stature—total posterior arm length	Stature—vertical trunk girth	Chest girth at armseye—hip girth	Chest girth at armseye—total posterior arm length	Chest girth at armseye—vertical trunk girth	Hip girth—total posterior arm length	Hip girth—vertical trunk girth	Total posterior arm length—vertical trunk girth
Hip height.....	.814	.812	.948	.845	1.970	1.970	1.974	1.974	.792	.948	.843	.948	.842	.949
Weight.....					.942	.961	.862	.926	.962	.936	.954	.959	.966	.929
Stature.....	.860	.859	.956	.906					.833	.951	.905	.953	.904	.965
Cervicale height.....	.859	.858	.957	.904	1.992	1.992	1.993	1.992	.832	.952	.902	.954	.902	.965
Tihiale height.....	.806	.805	.924	.833	1.945	1.945	1.949	1.948	.785	.923	.830	.924	.829	.925
Bitrochanteric diameter.....	.925	.950	.929	.927	.902	.954	.846	.887	.947	.896	.905	.953	.950	.891
Chest girth at armseye.....	.921	.920	.919	.904		.904	.869					.906	.909	.874
Waist girth.....	.830	.832	.827	.821	.812	.835	.620	.728	.841	.811	.810	.831	.827	.721
Hip girth.....	.952		.950	.951	.912		.821	.891		.908	.925			.894
Neck-base girth.....	.798	.789	.796	.802	.797	.782	.736	.785	.785	.791	.805	.778	.793	.788
Armseye girth.....	.898	.893	.897	.897	.888	.887	.820	.868	.890	.888	.895	.889	.892	.875
Upper-arm girth.....	.839	.853	.855	.838	.811	.868	.607	.744	.856	.811	.810	.864	.852	.732
Total posterior arm length.....	.838	.835		.862	.949	.948		.947	.818		.861			.858
Thigh girth.....	.880	.929	.885	.881	.831	.939	.690	.787	.929	.830	.840	.937	.934	.785
Maximum calf girth.....	.900	.909	.900	.899	.856	.899	.767	.832	.901	.851	.866	.898	.900	.833
Knee girth.....	.899	.913	.903	.900	.880	.917	.826	.863	.908	.872	.879	.915	.912	.866
Total crotch length.....	.870	.879	.875	1.897	.855	.885	.815	1.888	.868	.839	1.891	.877	1.903	1.889
Vertical trunk girth.....	.926	.925	.937		.936	.943	.904		.905	.910		.923		

GIRLS

Waist height.....	0.821	0.822	0.955	0.878	1.0.981	1.0.981	1.0.983	1.0.981	0.806	0.953	0.878	0.954	0.878	0.959
Hip height.....	.782	.781	.943	.833	1.964	1.965	1.968	1.969	.767	.943	.833	.943	.832	.945
Weight.....					.945	.970	.840	.922	.973	.940	.957	.970	.972	.923
Stature.....	.837	.837	.955	.905					.819	.951	.905	.954	.906	.966
Cervicale height.....	.839	.840	.956	.905	1.992	1.992	1.993	1.992	.822	.952	.905	.955	.905	.966
Tihiale height.....	.771	.771	.917	.816	1.936	1.937	1.941	1.940	.757	.916	.815	.916	.815	.918
Bitrochanteric diameter.....	.936	.959	.939	.940	.913	.964	.839	.899	.958	.905	.921	.962	.961	.902
Chest girth at armseye.....	.926	.925	.925	.925	.910	.784	.861					.911	.912	.864
Waist girth.....	.812	.795	.808	.802	.810	.802	.563	.695	.813	.807	.801	.795	.790	.679
Hip girth.....	.967	.967	.966	.925			.817	.907		.921	.941			.907
Neck-base girth.....	.794	.790	.802	.800	.791	.787	.734	.779	.781	.791	.797	.789	.790	.785
Armseye girth.....	.889	.883	.886	.886	.878	.877	.786	.847	.885	.879	.885	.879	.879	.852
Upper-arm girth.....	.834	.837	.854	.840	.812	.860	.573	.734	.841	.810	.806	.852	.841	.714
Total posterior arm length.....	.817	.817		.859	.950	.949		.948	.803		.859			.857
Thigh girth.....	.913	.936	.920	.915	.863	.945	.693	.819	.936	.863	.873	.942	.940	.812
Maximum calf girth.....	.899	.903	.898	.898	.852	.892	.744	.824	.895	.848	.863	.892	.893	.825
Knee girth.....	.900	.908	.903	.901	.874	.908	.800	.851	.903	.869	.877	.908	.904	.855
Total crotch length.....	.877	.885	.881	1.903	.859	.891	.801	1.893	.879	.845	1.897	.886	1.908	1.892
Vertical trunk girth.....	.922	.924	.940		.941	.953	.905		.911	.915		.935		

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 19.—Squares of the multiple correlations of each of 19 measurements on a selected combination of 3 measurements, based on a sample of 32,165 boys and 31,919 girls aged 4 to 14

BOYS

Measurement	Weight—total arm length		Hip girth—total arm length		Stature—weight	
	Hip girth	Chest girth	Stature	Chest girth	Hip girth	Chest girth
Waist height.....	0.953	0.953	10.983	0.953	10.981	0.981
Hip height.....	.948	.948	1.975	.948	1.971	.971
Weight.....			.962	.966		
Stature.....	.956	.956		.953		
Cervicale height.....	.957	.957	1.993	.954	1.992	.992
Tihiale height.....	.924	.924	1.949	.924	1.945	.945
Bitrochanteric diameter.....	.954	.930	.954	.953	.955	.930
Chest girth at armseye.....	.923		.906	.922		
Waist girth.....	.844	.845	.836	.853	.854	.854
Hip girth.....		.952		.952		.952
Neck-base girth.....	.796	.803	.783	.796	.797	.805
Armseye girth.....	.900	.904	.890	.901	.898	.902
Upper-arm girth.....	.878	.867	.868	.879	.888	.875
Total posterior arm length.....				.948	.949	
Thigh girth.....	.938	.889	.939	.937	.941	.892
Maximum calf girth.....	.910	.901	.899	.901	.910	.900
Knee girth.....	.918	.904	.917	.916	.919	.905
Total crotch length.....	.883	.875	.886	.878	.889	.880
Vertical trunk girth.....	.937	.937	.944	.927	.950	

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 19.—Squares of the multiple correlations of each of 19 measurements on a selected combination of 3 measurements, based on a sample of 32,165 boys and 31,919 girls aged 4 to 14—Continued

GIRLS

Measurement	Weight—total arm length		Hip girth—total arm length		Stature—weight	
	Hip girth	Chest girth	Stature	Chest girth	Hip girth	Chest girth
Waist height.....	0.955	0.955	10.983	0.954	10.981	0.981
Hip height.....	.944	.943	1.970	.943	1.965	.965
Weight.....			.970	.975		
Stature.....	.955	.955		.954		
Cervicale height.....	.956	.956	1.993	.955	1.992	.992
Tihiale height.....	.917	.917	1.941	.916	1.931	.937
Bitrochanteric diameter.....	.962	.940	.964	.962	.964	.941
Chest girth at armseye.....	.926		.911	.926		
Waist girth.....	.813	.832	.804	.831	.826	.842
Hip girth.....		.967		.967		.967
Neck-base girth.....	.802	.805	.790	.798	.800	.803
Armseye girth.....	.888	.894	.879	.892	.886	.892
Upper-arm girth.....	.866	.863	.860	.867	.878	.874
Total posterior arm length.....				.949	.950	
Thigh girth.....	.945	.922	.945	.944	.949	.925
Maximum calf girth.....	.903	.899	.892	.895	.903	.899
Knee girth.....	.911	.903	.909	.909	.911	.904
Total crotch length.....	.889	.881	.892	.886	.893	.886
Vertical trunk girth.....	.942	.940	.954	.936	.956	.955

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

The results in tables 18 and 19, when analyzed in the light of the practical considerations mentioned above, led to the choice of two combinations as possible controls—stature and weight, or stature and hip girth. The combinations chosen were limited to two measurements, because a combination of three was found to be only slightly more effective in controlling all the remaining measurements than a combination of two.<sup>17</sup> Moreover, a combination of three or more measurements would so complicate a classification or sizing scheme as to be impractical. The combinations were also limited to a length and a girth.<sup>18</sup> This was done since, as was shown in the previous section and corroborated in the study of multiple regression (table 18), a length and a girth in combination was found to control the variations in all the measurements of the set better than a combination consisting of two lengths or two girths.

It is to be noticed that stature appears in both combinations selected. This is because, of all linear measurements, stature is easiest to take on a child. It also has the largest range and controls the variations of all other lengths better than any other measurement.

The vertical trunk girth was eliminated because it is not superior as a control measurement to either weight or hip girth, (tables 9 to 13) and, moreover, is a difficult measurement to take on a child.

Much study was given to the choice between chest girth and hip girth. Finally, the former was eliminated for a number of reasons. From an anthropological point of view, this girth being a measurement of the bony structure of the body, would seem to be preferable to hip girth. However, in fitting garments, not only must the skeletal parts of the body be taken into consideration but also the fleshy and fatty parts. In this respect, hip girth is superior to chest girth. This can be gathered, for instance, from table 18 where it is shown that the multiple correlations obtained on the basis of stature and hip girth, are on the whole, larger than those given on the combination of stature and chest girth. This is especially true for measurements such as thigh girth, maximum calf girth, and upper-arm girth.

The fact that the multiple correlation of weight with stature and hip girth is larger than the multiple correlation of weight with stature and chest girth again indicates that hip girth is more highly related to the fleshy parts of the body than is chest girth (see footnote 20). Moreover, a study of table 3 and figure 5 indicates that, of the two measurements—hip girth and chest girth—the former is less subject to errors of measurement.

Another analysis was made using the residual generalized variance as a criterion, which indicated that hip girth in combination with stature was slightly better statistically than chest girth in combination with stature.<sup>19</sup>

<sup>17</sup> The introduction of chest girth into a combination of stature and weight (or stature and hip girth) results in a further reduction in the variations of some of the girths. This can be seen by comparing column 15 of table 18 with column 7 of table 19. However, the reduction did not appear to be sufficiently great to warrant its introduction into the sizing scheme.

<sup>18</sup> Weight was found to be more highly related to the girths than to the linear measurements and hence may be considered in the same sense as a girth.

<sup>19</sup> For this test, the quantities  $Z_{1c} = (1-r_{1c}^2) / (1-r_{2c}^2)$  and  $Z_{1h} = (1-r_{1h}^2) / (1-r_{2h}^2)$  were calculated for five measurements for the sample of girls and boys. These measure-

After many conferences with the committee of consumers, retailers, and manufacturers set up by the American Standards Association (p. III), it was decided for a variety of practical reasons that hip girth, which plays an important role in the construction of garments, would be a much better choice than weight. Consequently, stature and hip girth<sup>20</sup> were chosen as the basis for the classification of the children and for a proposed system of body measurements for the sizing of garments and patterns (10).

TABLE 20.—Correlations of 12 girths with the first principal component holding stature constant, based on a sample of 32,165 boys and 31,919 girls aged 4 to 14

Measurement	Correlations with first principal component (boys)	Measurement	Correlations with first principal component (girls)
Hip girth.....	0.9351	Weight.....	0.9471
Weight.....	.9263	Hip girth.....	.9454
Thigh girth.....	.8980	Thigh girth.....	.9263
Upper-arm girth.....	.8922	Upper-arm girth.....	.8974
Chest girth at armseye.....	.8302	Chest girth at armseye.....	.8596
Maximum calf girth.....	.8272	Bitrochanteric diameter.....	.8378
Waist girth.....	.8258	Maximum calf girth.....	.8329
Bitrochanteric diameter.....	.8180	Waist girth.....	.8302
Knee girth.....	.7753	Knee girth.....	.8021
Armseye girth.....	.7506	Armseye girth.....	.7703
Vertical trunk girth.....	.7234	Vertical trunk girth.....	.7544
Neck-base girth.....	.5521	Neck-base girth.....	.5703

The degree of relationships existing between pairs of measurements when stature and hip girth are used as control measurements may be gathered from table 21, which shows the partial correlations and corresponding  $z$  values when stature and girth of hip are held constant. The lower and upper fiducial limits<sup>21</sup> of some of the correlations found in table 21 are given in table 22.

ments were: Waist girth, neck-base girth, total posterior arm length, thigh girth, and vertical trunk girth. The quantities  $r_{1c}$  and  $r_{2c}$  are the two canonical correlations of the set of five measurements on stature and chest girth, and  $r_{1h}$  and  $r_{2h}$  are the two canonical correlations of the five measurements on stature and hip girth. It is pointed out on page 134 that the larger the value of  $z$ , the larger will be the residual generalized variance of the five measurements. The  $z$  value for chest girth was found to be larger than the  $z$  value for hip girth. This held for both sexes.

<sup>20</sup> Since stature was the logical choice to represent the linear measurements, a supplementary analysis was made to determine which of the girths to use in combination with it as a control variable. This analysis consisted in obtaining the principal components (3, 5) of a set of 12 cross-sectional measurements when stature was held constant. That is, these principal components were obtained from the matrix of partial correlations of the 12 variables when stature was held constant.

The coefficients of the corresponding measurements for the first principal components are given in table 20. (These coefficients are also the correlations between the component and the corresponding measurements.) The results from this analysis showed: (1) The first principal component explains 70 percent of the residual variations in the 12 girths when stature is held constant for the sample of boys and 70 percent for the sample of girls. (2) In both samples weight and hip girth are most highly correlated with the first principal component.

The above results seem to indicate that the first principal component, which accounts for a great portion of the variations in the girths, is a weight component, and that a good measure of this component is either weight itself or hip girth. A study of tables of correlations (tables 6 and 7) also shows that of all the girths hip girth is most highly correlated with weight. Thus, it appears, from a statistical point of view, that little or no information is lost when hip girth is chosen in preference to weight.

<sup>21</sup> The fiducial limits for the partial correlations in table 22 were obtained in the following manner: Since  $z$  is normally distributed with mean  $\xi$  and standard deviation  $1/\sqrt{N-5}$  where  $N$  is the number of cases in the sample, the quantity  $(z-\xi)\sqrt{(N-5)}$  was equated to  $\pm 1.96$  and two values for  $\xi$  were obtained from the equation. These two values constitute the fiducial limits for  $z$ . The number 1.96 is chosen, since the probability that a normal variate will deviate from its mean by as much as 1.96 times its standard error is 0.05. The fiducial limits were obtained for the  $z$  values given in table 21. These limits were then reconverted to correlations. For a discussion of fiducial limits see Fisher (1).



TABLE 21.—Partial correlations (upper right-hand section) with corresponding *z* values (lower left-hand section) when stature and hip girth are held constant, for a sample of 32,165 boys and 31,919 girls, aged 4 to 14

BOYS

Measurement	Age	Waist height	Hip height	Weight	Cervical height	Tibial height	Bitrochanteric diameter	Chest girth at armscye	Waist girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth
Age	0.169	0.167	0.213	-0.067	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023
Waist height	-0.125	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.279
Hip height	0.213	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.370
Weight	-0.067	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Cervical height	0.115	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Tibial height	0.061	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Bitrochanteric diameter	0.062	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Chest girth at armscye	0.098	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Waist girth	-0.037	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Neck-base girth	-0.033	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Armscye girth	0.115	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Upper-arm girth	-0.016	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Total posterior arm length	0.143	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Thigh girth	-0.013	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Maximum calf girth	0.029	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Knee girth	0.013	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Total crotch length	-0.052	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366
Vertical trunk girth	-0.023	0.167	0.213	0.115	0.061	0.062	0.098	-0.037	-0.033	0.115	-0.016	0.143	-0.013	0.029	0.013	-0.052	-0.023	-0.366

GIRLS

Age	0.058	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Waist height	0.058	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Hip height	0.059	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Weight	-0.109	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Cervical height	0.085	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Tibial height	0.009	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Bitrochanteric diameter	0.091	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Chest girth at armscye	0.059	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Waist girth	-0.130	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Neck-base girth	-0.063	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Armscye girth	0.031	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Upper-arm girth	-0.085	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Total posterior arm length	0.133	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Thigh girth	-0.011	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Maximum calf girth	-0.014	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Knee girth	-0.050	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Total crotch length	-0.036	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043
Vertical trunk girth	0.043	0.058	0.059	-0.109	0.085	-0.009	0.091	0.059	-0.129	-0.063	0.031	-0.085	0.133	-0.011	-0.014	-0.050	-0.036	0.043

<sup>1</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 22.—Fiducial limits of partial correlations when stature and hip girth are held constant for 15 measurements on 32,165 boys (upper right-hand section) and 31,919 girls (lower left-hand section), aged 4 to 14

Measurement	Age	Hip height	Weight	Bitrochanteric diameter	Chest girth at armscye	Waist girth	Neck-base girth	Armscye girth	Upper-arm girth	Total posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Total crotch length	Vertical trunk girth						
																<i>z</i>	<i>z</i>	<i>z</i>	<i>z</i>	<i>z</i>	<i>z</i>
Age	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012						
Hip height	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012						
Weight	-0.080	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012					
Bitrochanteric diameter	0.050	-0.080	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012				
Chest girth at armscye	0.090	-0.080	0.050	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012			
Waist girth	-0.048	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012		
Neck-base girth	-0.044	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012		
Armscye girth	0.100	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	0.100	-0.080	0.050	0.090	-0.048	-0.044
Upper-arm girth	-0.027	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.027	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	-0.027	-0.044
Total posterior arm length	0.129	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	0.129	-0.080	0.050	0.090	-0.048	-0.044
Thigh girth	-0.024	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.024	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	-0.024	-0.044
Maximum calf girth	0.018	-0.080	0.050	0.090	-0.048	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	0.018	-0.080	0.050	0.090	-0.048	-0.044
Knee girth	0.002	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	0.002	-0.044	0.100	-0.027	0.129	-0.024	0.018	0.002	-0.060	-0.034	-0.012	0.002	-0.044
Total crotch length	-0.060	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.060	-0.044	0.100	-0.027	0.129	-0.024	0.018	-0.060	-0.080	0.050	0.090	-0.048	-0.044
Vertical trunk girth	-0.034	0.050	-0.080	0.090	0.207	-0.080	0.050	0.090	-0.034	-0.044	0.100	-0.027	0.129	-0.024	0.018	-0.034	-0.080	0.050	0.090	-0.048	-0.044

# Proposed System of Sizing Based on Height and Hip Measure<sup>22</sup>

Having decided upon a combination of stature and hip girth as a control, the next step was to devise a system of sizes—taking into account the frequency with which different combinations of these measure-

ments occur among children in the sample studied. In the case of both boys and girls, these frequency distributions constitute a fan-shaped region (figs. 6 and 7).<sup>22a</sup> Photographs of three-dimensional models of these frequencies of distribution, (together with distributions of stature and weight for boys and stature and age for boys) are reproduced in figures 8 to 11. Experiments with various mathematical procedures<sup>23</sup> led to the decision that the most practical scheme was to divide these regions into subregions that would cover the great

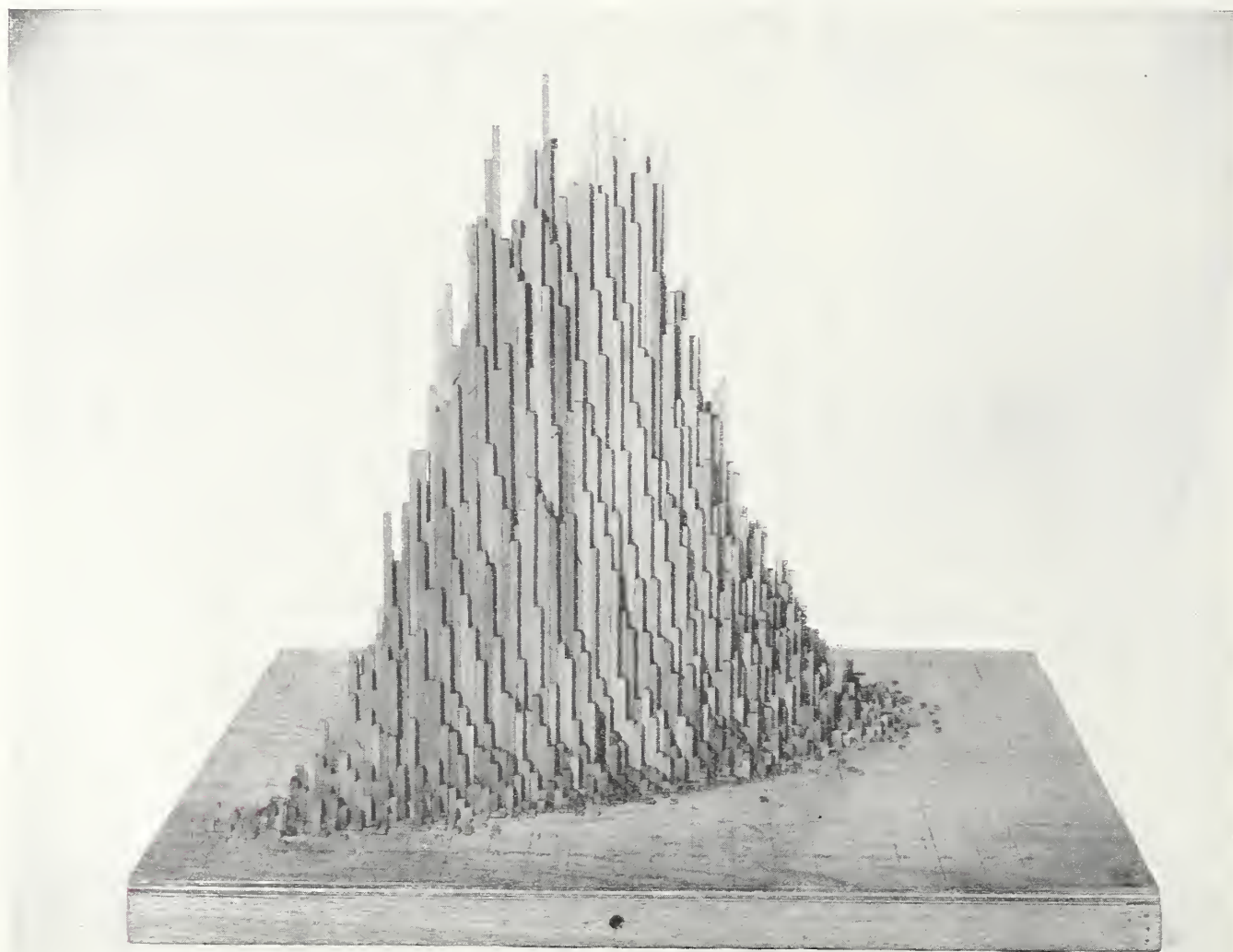


FIGURE 8.—Three-dimensional model of the distribution of 69,661 boys 4 to 17 years of age on the basis of stature and girth of hips.

ments occur among children in the sample studied. In the case of both boys and girls, these frequency distributions constitute a fan-shaped region (figs. 6 and 7).<sup>22a</sup> Photographs of three-dimensional models of these frequencies of distribution, (together with distributions of stature and weight for boys and stature and age for

majority of cases. The subregions finally selected were rectangles.

The number and size of these rectangles were decided upon by consultations with representatives of the garment and pattern trades. After a number of conferences it was agreed that approximately 13 "regular"

<sup>22</sup> Though experiments on sizing schemes were carried out on the subsamples, the analysis reported in this section is based on 133,000 schedules (the total number of schedules that arrived from the field minus those rejected for the reasons given on p. 22).

<sup>22a</sup> In pocket on back of cover.

<sup>23</sup> One of the mathematical procedures that was considered, for example, was setting up regression surfaces. These were found to be rather complicated. However, satisfactory approximations to them were calculated and are given in the appendix (p. 134). These data may be used to calculate body dimensions corresponding to any desired combination of height and hip girth.

sizes (rectangles) for each sex with corresponding auxiliary sizes would be a reasonable number. A regular size is defined as that rectangle that for a given height interval falls on the modal point of the distribution of hip girth. Figures 6 and 7<sup>24</sup> give the bivariate dis-

The letter *C* designates the regular rectangles in all these figures with the exception of  $C_{14}$ , which indicates a size for a group of boys so tall as to place them in men's sizes. The letters *A* and *B* are used to designate rectangles below the regular and *D* and *E* those above

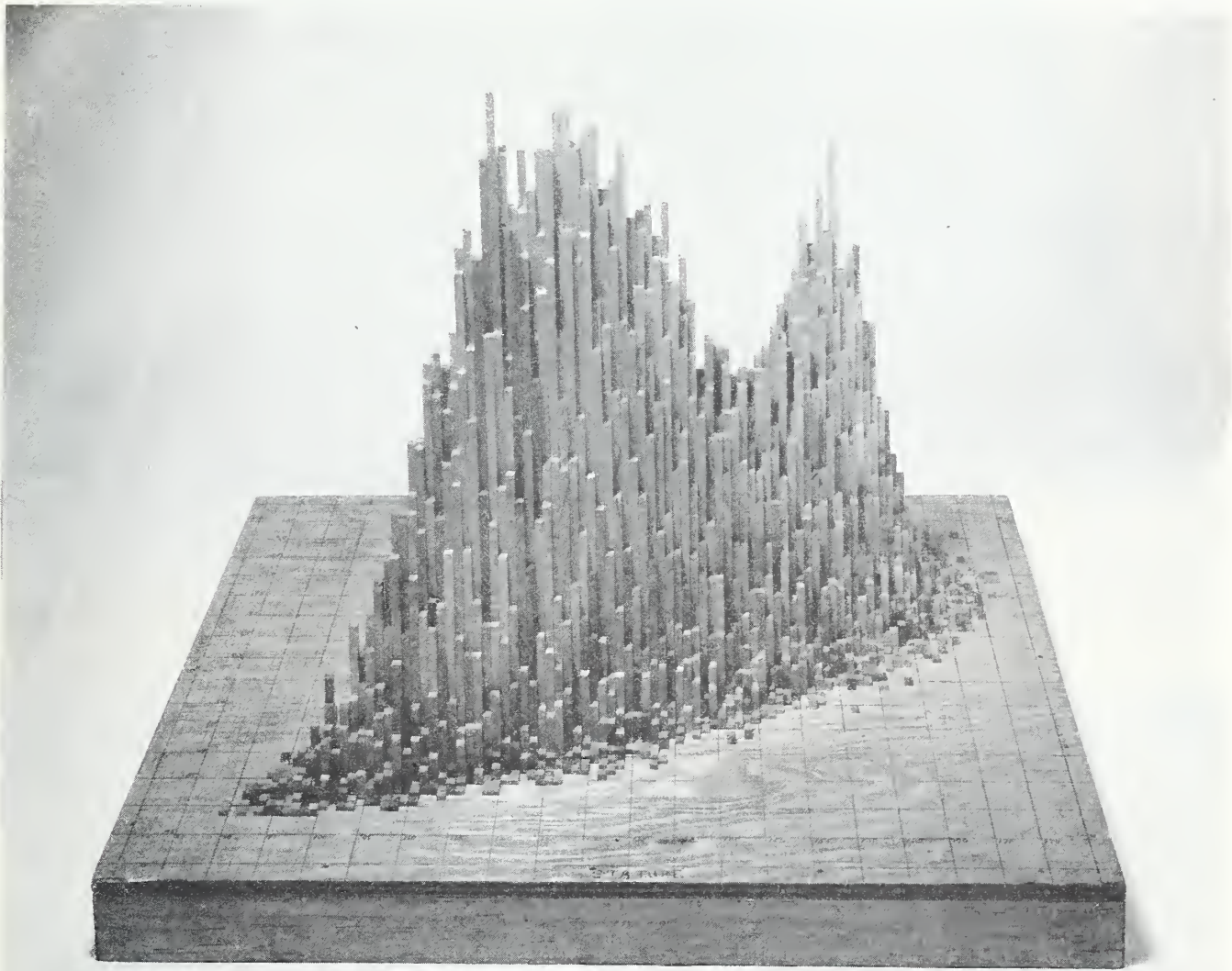


FIGURE 9.—Three-dimensional model of the distribution of 64,146 girls 4 to 17 years of age on the basis of stature and girth of hips.

tribution of stature and hip girth for boys and girls, respectively, with the rectangles superimposed.

There are 13 rectangles shown in figure 6 designating regular sizes for boys 4 to 17 years of age and 39 rectangles designating auxiliary sizes. In figure 7, are shown 12 rectangles indicating regular sizes for girls of these ages and 37 rectangles indicating auxiliary sizes.

A clearer picture of these rectangles is given by figures 12 and 13. These give the size of the intervals, the approximate height (in inches) for each interval and the approximate hip measure (in inches) for each interval. They also show the percentage of children in each rectangle, calculated on the basis of the total number of children in that height interval.

<sup>24</sup> In these figures it should be noted that the regression curve of hip girth on stature passes through the central rectangles. This indicates that the mean and the mode for hip girth for a given interval of stature are not far apart.

the regular. From these figures, a child may be located in the proper rectangle by reading his height on the horizontal scale and his hip measure on the vertical scale. The rectangle in which he is thus placed determines his size designation.

The 13 regular rectangles for boys (fig. 12) designated by the letter *C* (excluding  $C_{14}$ ) represent 49.8 percent of the total sample of boys. The 12 regular rectangles for girls (fig. 13) indicated by the same letter represent 41.8 percent of the sample.

In the case of the boys, the *B* and *D* sizes include respectively 17.8 and 21.5 percent of the sample. For the girls, these include respectively 22.5 percent and 21.7 percent of the sample. The sizes designated by *A*, *B*, *D*, and *E* (auxiliary sizes) may be of assistance to those manufacturers who have a demand for garments for children whose girths in relation to their

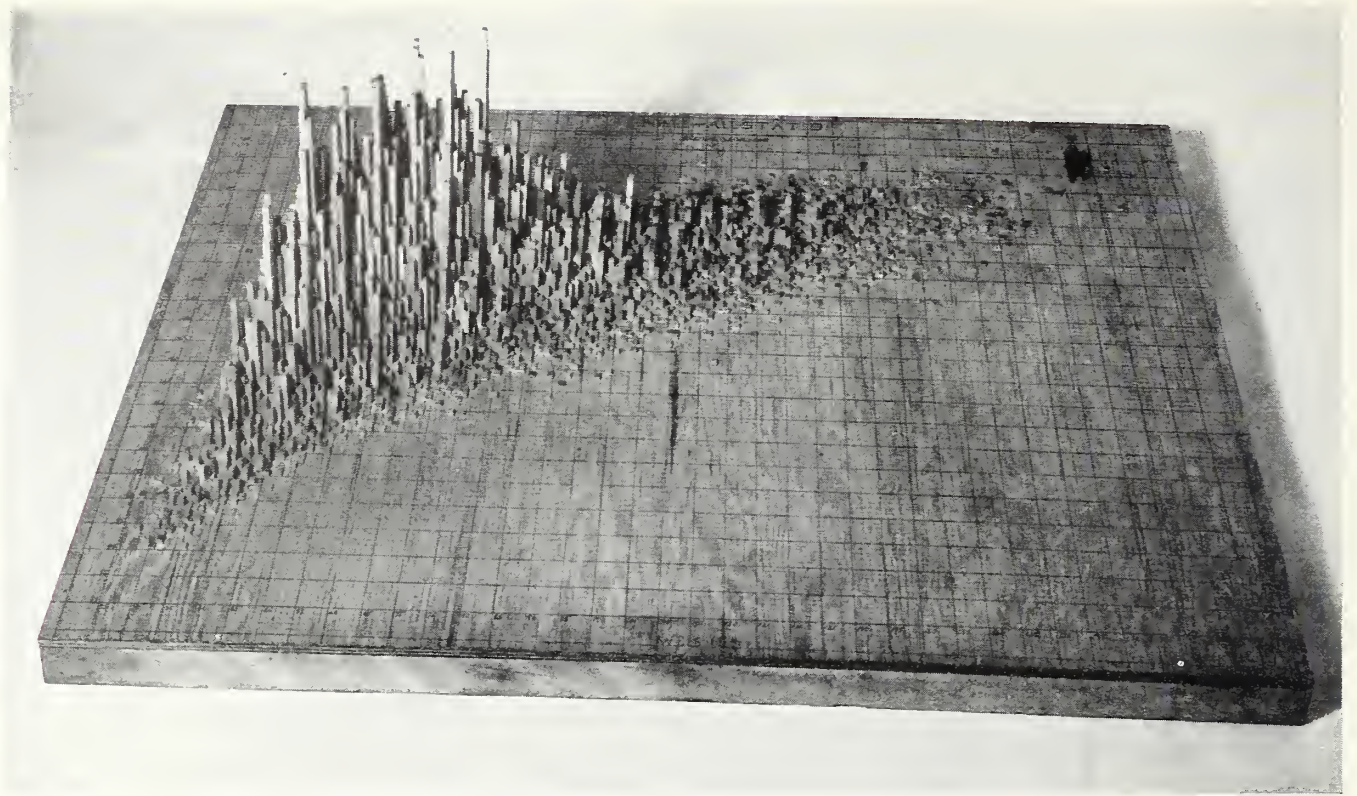


FIGURE 10.—Three-dimensional model of the distribution of 69,661 boys 4 to 17 years of age on the basis of stature and weight.

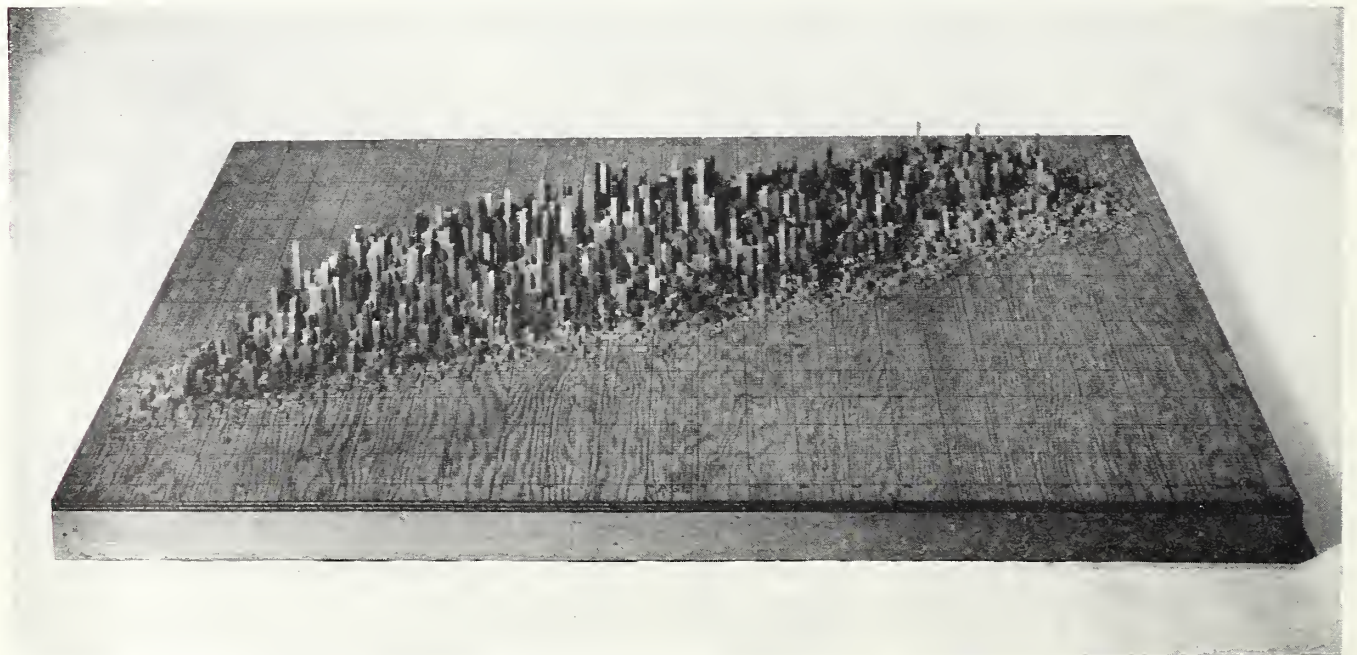


FIGURE 11.—Three-dimensional model of the distribution of 69,661 boys 4 to 17 years of age on the basis of stature and age.

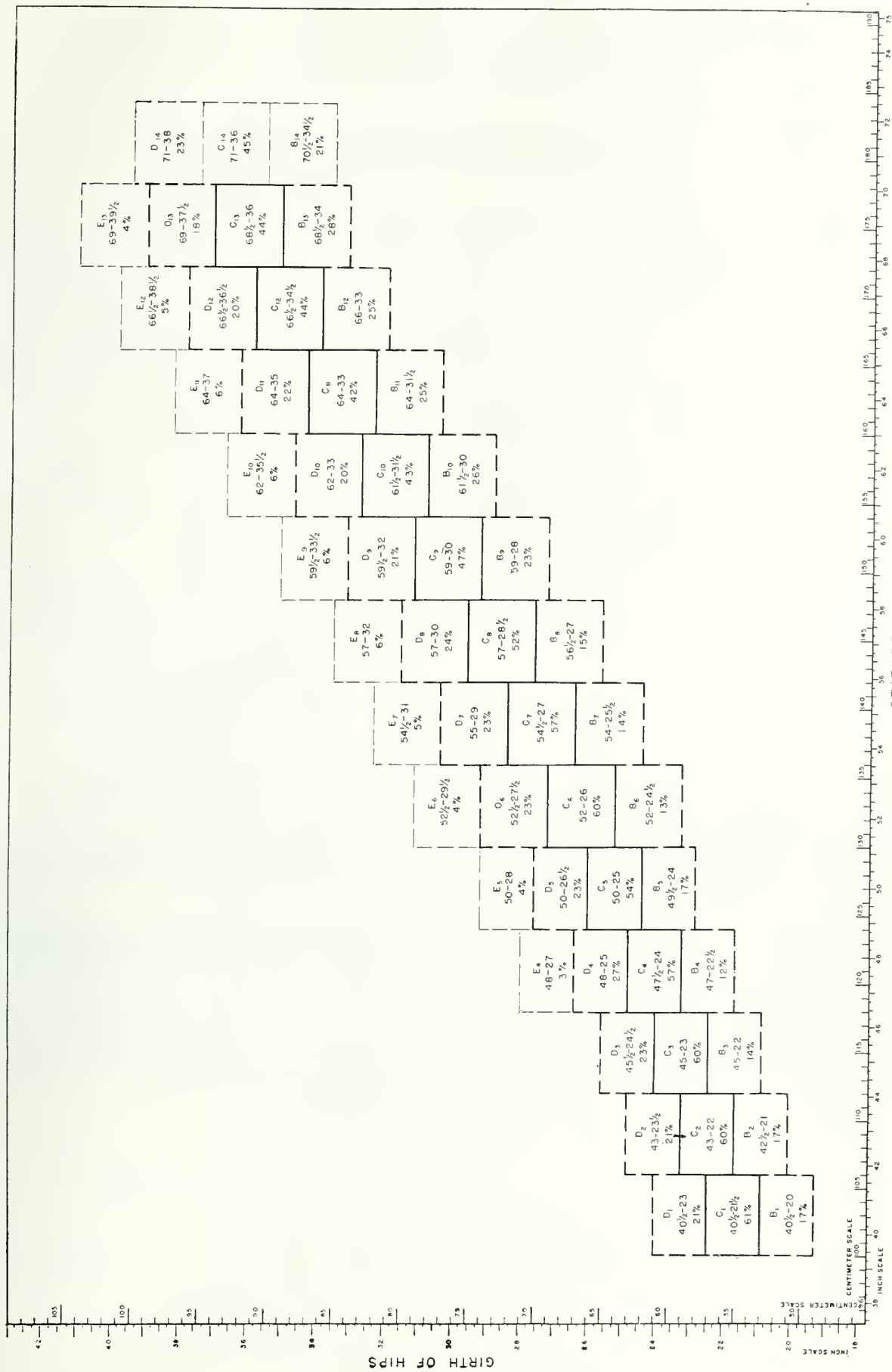


FIGURE 12.—System of boys' sizes based on stature and hip girth following the distribution shown in figure 6. The symbols, C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, and others in the sequence, designating rectangles outlined by unbroken lines, refer to the regular sizes as given in table 23. Rectangles outlined by dotted lines show sizes for children whose proportions vary from those of the majority. The percentages (given here in rounded figures) are based on the total number of children in a given height interval. (Fig. 6 is in pocket on back of cover.)

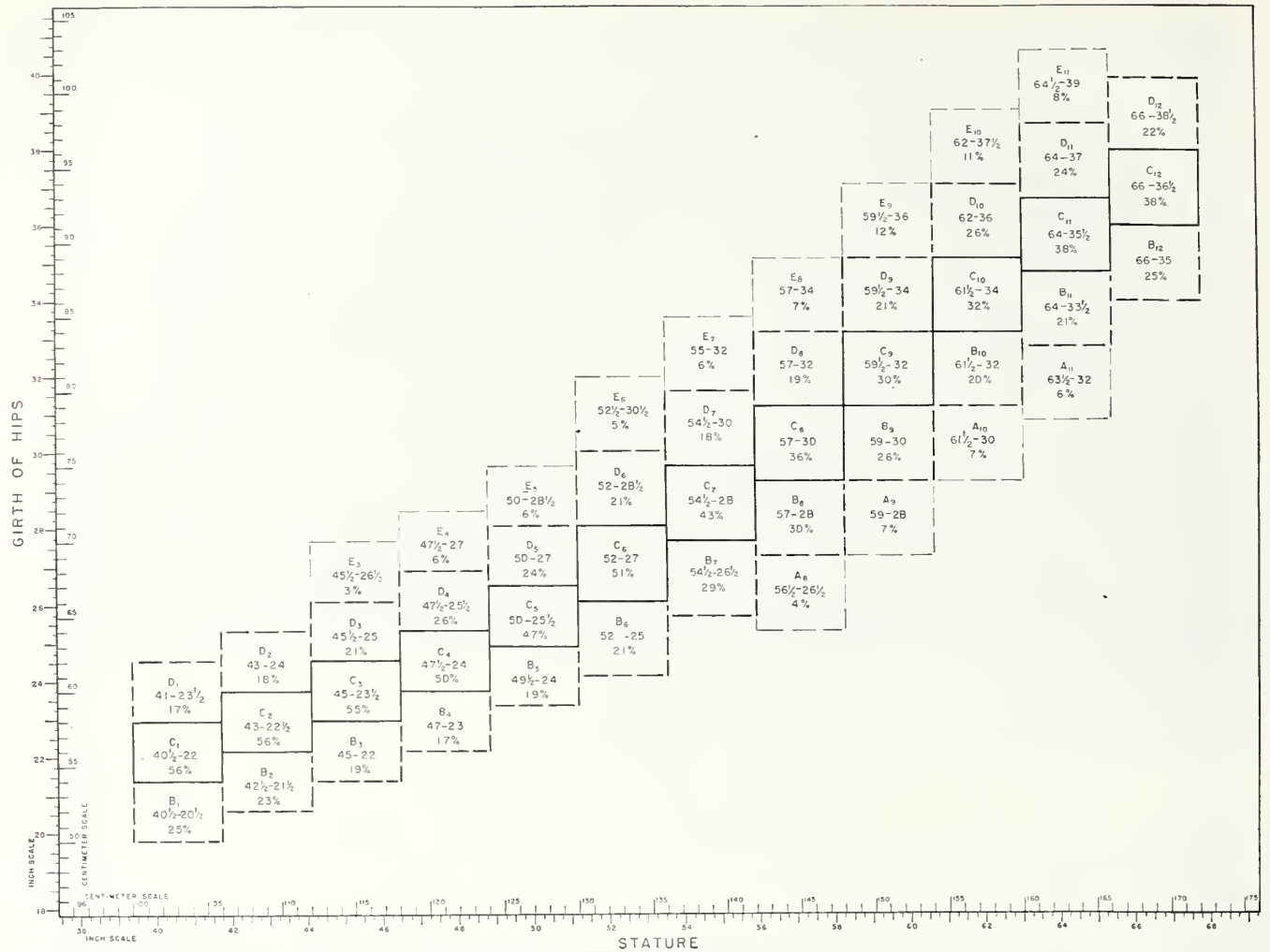


FIGURE 13.—System of girls' sizes based on stature and hip girth following the distribution shown in figure 7. The symbols,  $C_1$ ,  $C_2$ ,  $C_3$ , and others in the sequence, designating rectangles outlined by unbroken lines, refer to the regular sizes as given in table 25. Rectangles outlined by dotted lines show sizes for children whose proportions vary from those of the majority. The percentages (given here in rounded figures) are based on the total number of children in a given height interval. (Fig. 7 is in pocket on back of cover.)

heights are much smaller or much larger than those of the majority of children.

The statistic that was used to determine the measurements for each size was selected on the basis of a study of the distributions of many of the important measurements in different height-hip rectangles. Since these distributions were found to be symmetrical, means for each measurement within a rectangle seemed to be the best choice. The proposed sizes, therefore, consist of

means (in inches) of each of the 36 body measurements and for each rectangle. Moreover, the means may be expected to be stable since the number of cases in each of the rectangles was large.

The means for each of the 36 measurements and the percentage corresponding to each of the rectangles given in figures 12, and 13, are shown in tables 23, 24, 25, and 26. Tables 24 and 26 represent the auxiliary sizes for boys and girls respectively.

TABLE 23.—Proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $C_1$ ,  $C_2$ ,  $C_3$ , show corresponding intervals on fig. 12) and designated by approximate height and hip dimensions in inches

Item No. and measurement	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$	$C_9$	$C_{10}$	$C_{11}$	$C_{12}$	$C_{13}$
	Height, 40½; hip, 21½	Height, 43; hip, 22	Height, 45; hip, 23	Height, 47½; hip, 24	Height, 50; hip, 25	Height, 52; hip, 26	Height, 54½; hip, 27	Height, 57; hip, 28½	Height, 59; hip, 30	Height, 61½; hip, 31½	Height, 64; hip, 33	Height, 66½; hip, 34½	Height, 68½; hip, 36
1. Waist height.....inches	24	25¾	27¾	29	30¾	32½	34¼	36	37¾	39¾	40¾	42	43¾
2. Hip height.....do	19¼	20¾	21¾	23¾	24¾	26¼	27¾	29¾	30¾	32¼	33¾	35¾	37¾
3. Weight.....pounds	36¼	40	44½	49	55	61	68	75½	86	98	111	125½	136½
4. Stature.....inches	40½	42½	45¾	47½	49¾	52½	54½	56¾	59¼	61¾	64	66¾	68¾
5. Cervicale height.....do	33¼	35¼	37¾	39¾	41¾	43¾	45¼	48	50¼	52½	54½	56¾	58¾
6. Tibiale height.....do	10½	11¼	12	12¾	13½	14¼	15	15¾	16¾	17¾	18	18½	19¼
7. Crotch height.....do	16½	18¼	19¾	21	22¼	23¾	25½	26½	27¾	29	30	30¾	31¾
8. Bitrochanteric diameter.....do	7¾	8½	8¾	9¾	10¾	11¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾
9. Shoulder slope.....degrees	26	25½	26	25½	25½	25	25	25	25	24½	25	25	25
10. Anterior chest width.....inches	7¾	8	8¼	8¾	9	9¾	9¾	10¼	10¾	11¼	11¾	12¾	13¾
11. Anterior waist length.....do	8½	9	9½	9¾	10¼	10¾	11	11½	11½	12	12	12¾	13¾
12. Posterior chest width.....do	9¼	9½	9¾	10¼	10¾	11	11½	11½	12½	12½	13¼	13¾	14¼
13. Posterior waist length.....do	9¾	10¼	10¾	11¾	11¾	12	12½	12½	13¾	13¾	14¼	15¼	15¼
14. Chest girth at armseye.....do	21½	22½	23¼	24	24½	25¾	26½	27¾	29	30¾	32¾	34¼	35¼
15. Scye depth.....do	4½	5	5¼	5¼	5¾	5¾	6	6¾	6¾	7	7	7¾	7¾
16. Posterior hip arc.....do	10½	10¾	11¼	11¾	12¼	12¾	13¾	13¾	14½	15¼	16	16¾	17½
17. Maximum chest girth.....do	11¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22¾	23¾
18. Anterior chest arc.....do	11¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22¾	23¾
19. Waist girth.....do	19¾	20¾	21¾	22¾	23¾	24¾	25¾	26¾	27¾	28¾	29¾	30¾	31¾
20. Hip girth.....do	21½	22¼	23¾	25	26	27¼	28¾	29¾	31¼	33	33	34¾	35¾
21. Neck-base girth.....do	10¾	11½	11¾	12	12¼	12¾	13	13¾	13¾	14½	14½	15½	15½
22. Shoulder length.....do	2¾	3	3	3¼	3¼	3½	3½	3¾	3¾	4	4	4½	4½
23. Armseye girth.....do	9¾	10¼	10¾	11	11	11¾	12	12¾	13¾	13¾	14½	15½	16¼
24. Upper-arm girth.....do	6¾	6½	6¾	6¾	7	7	7½	7¾	8	8¾	8¾	9¾	10
25. Elbow girth.....do	7	7¼	7½	7¾	7¾	8	8¼	8¾	9	9	10	10	11
26. Upper posterior arm length.....do	8	8½	8¾	9	9¼	9¾	10	10½	11	11½	11½	12	12½
27. Total posterior arm length.....do	14¼	15	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22¾	23¾	24¾	25¼
28. Trunk line.....do	47	51	55	59	63	67	71	75	79	83	87	91	95
29. Waist to hips.....do	51	55	59	63	67	71	75	79	83	87	91	95	99
30. Thigh girth.....do	12¼	12¾	13	13¾	14¼	14¾	15½	16¾	17¾	18¾	18¾	19¾	20¾
31. Maximum calf girth.....do	8¾	9	9½	9¾	10	10½	10¾	11	11	11½	12¼	12¾	13¾
32. Knee girth.....do	8¾	9	9½	9¾	10	10½	10¾	11	11	11½	12¼	12¾	13¾
33. Total crotch length.....do	17¼	18	18¾	19¼	19¾	20¾	21½	22	22¾	23¾	24¾	25¾	26¾
34. Anterior crotch length.....do	8¾	9	9½	9¾	10	10½	10¾	11	11	11½	12¼	12¾	13¾
35. Extreme bend.....do	17	17¾	18¾	19¾	20¾	21¾	22¾	23¾	24¾	25	25	26	27
36. Vertical trunk girth.....do	37¾	38¾	40¼	41¾	43¼	44¾	46¾	48¾	50¾	53	56	58¾	60¾
37. Percentage.....percent.	61	60	60	57	54	50	47	43	43	43	42	44	44

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 24.—Auxiliary proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1$ ,  $B_2$ , show corresponding intervals on fig. 12) and designated by approximate height and hip dimensions in inches

Item No. and measurement	$B_1$	$B_2$	$B_3$	$B_4$	$B_5$	$B_6$	$B_7$	$B_8$	$B_9$	$B_{10}$	$B_{11}$	$B_{12}$	$B_{13}$	$B_{14}$
	Height, 42½; hip, 20	Height, 43; hip, 21	Height, 45; hip, 22	Height, 47; hip, 22½	Height, 49½; hip, 24	Height, 52; hip, 24½	Height, 54; hip, 25½	Height, 56½; hip, 27	Height, 59; hip, 28	Height, 61½; hip, 30	Height, 64; hip, 31½	Height, 66; hip, 33	Height, 68½; hip, 34	Height, 70½; hip, 34½
1. Waist height.....inches	23¾	25	28	28¾	30¼	32¼	34	35¾	37¾	39¾	40¾	42¾	43¾	45
2. Hip height.....do	19	20½	21¾	23¼	24½	26¼	27¾	29¼	30¾	32¼	33¾	34¾	35¾	36¾
3. Weight.....pounds	33¾	37	41	45	50¼	55½	62	69	78	88	100¼	113	124¼	136½
4. Stature.....inches	40¾	42½	44¾	47¼	49¾	51¾	54¼	56¾	59	61¾	63¾	66¼	68¾	70¾
5. Cervicale height.....do	32	35	37¾	39	41¾	43¾	45¾	47¾	50	52¾	54¾	56¾	58¾	60¾
6. Tibiale height.....do	10¾	11½	12	12¾	13¾	14¼	15	15¾	16¾	17¾	18¼	18¾	19¼	19¾
7. Crotch height.....do	17	18¾	19¾	20¾	22¼	23¼	25¼	26¾	27¾	29¼	30¾	31¼	32¼	33¾
8. Bitrochanteric diameter.....do	7¼	7½	7¾	8	8¾	9	9¾	9¾	10¼	10¾	11¼	12	12¾	13
9. Shoulder slope.....degrees	25½	24½	25½	25½	25½	25	25	25	25	24¼	24¼	24	25	25
10. Anterior chest width.....inches	7½	7¾	8	8¾	9	9¾	9¾	10¾	10¾	11¾	11¾	12¾	12¾	13¾
11. Anterior waist length.....do	8½	8¾	9	9¾	10	10¾	10¾	11	11½	11¾	12¾	12¾	13¾	13¾
12. Posterior chest width.....do	9	9¼	9¾	10	10¾	10¾	11	11¾	11¾	12¾	12¾	13¾	13¾	14¾
13. Posterior waist length.....do	9¾	9¾	10¼	10	11	11¾	12	12¼	12¾	13¼	14	14½	15	15
14. Chest girth at armseye.....do	21¼	21¾	22¼	23¾	24¾	24¾	25¾	26¾	28	29¾	30¾	32¾	33¾	34¾
15. Scye depth.....do	4¾	4¾	5	5¾	5¾	6	6¾	6¾	7	7¾	7¾	8	8	8
16. Posterior hip arc.....do	10¾	10¾	10¾	11	11½	11¾	12¾	13	13¾	14¾	15¾	16¾	16¾	17¾
17. Maximum chest girth.....do	11	11½	11½	12	12½	13	13½	14	14¾	15¼	15¾	16¾	17¾	18¾
18. Anterior chest arc.....do	11	11½	11½	12	12½	13	13½	14	14¾	15¼	15¾	16¾	17¾	18¾
19. Waist girth.....do	19¼	19½	20	20¾	21	21½	22	22¾	23¼	24	24¾	25¾	26¾	27
20. Hip girth.....do	20¼	21	21¾	22¾	23¼	24½	25¾	26¾	28¼	29¼	31¾	32¾	34	35
21. Neck-base girth.....do	10¾	10¾	11¼	11¾	12	12	12¾	12¾	13	13¼	14	14½	15	15
22. Shoulder length.....do	2¾	2¾	2¾	3	3¼	3	3¾	3¾	3¾	4	4¼	4	4½	4½
23. Armseye girth.....do	9¾	9¾	10¼	10	11	11¾	12	12¾	13¼	14	14¾	15¾	16¾	16¾
24. Upper-arm girth.....do	6¾	6¾	6¾	6¾	6¾	6¾	7	7	7¾	7¾	8¾	8¾	9	9
25. Elbow girth.....do	6¾	7	7¼	7¾	7¾	8	8¾	8¾	9	9½	10½	10	10	11
26. Upper posterior arm length.....do	7¾	8¾	8¾	9	9¾	10	10	10	11	11¾	12¾	13¾	14	14
27. Total posterior arm length.....do	13¾	14¾	15¾	16¾	17½	18¾	19¾	20¾	21¾	22¾	23¾	24¾	25¾	26
28. Trunk line.....do	47	51	55	59	63	67	71	75	79	83	87	91	95	99
29. Waist to hips.....do	51	55	59	63	67	71	75	79	83	87	91	95	99	103
30. Thigh girth.....do	11¼	11¾	12¼	12¾	13¼	13¾	14¾	15	15¾	16¾	17¾	18¾	19	19¼
31. Maximum calf girth.....do	7¾	8¼	8¾	8¾	9¼	9¾	10	10¾	11	11¾	12¾	13¾	14	14¼
32. Knee girth.....do	8¾	8¾	9	9	10	10¾	10¾	11	11¾	12¾	13¾	14	14	14¾
33. Total crotch length.....do	16¾	17¾	18¼	18¾	19¾	20¾	21¼	22¼	23¼	24¾	25¾	27	28	28¾
34. Anterior crotch length.....do	8¼	8¾	9	9	10	10¾	10¾	11	11¾	12¾	13¾	14	14	14¾
35. Extreme bend.....do	16¼	17	18	19¼	20¼	21¾	22¾	23¾	24¾	25¾	26¾	27¾	28	29
36. Vertical trunk girth.....do	36¾	37¾	39¼	40¾	42¾	43¾	45¾	47¼	49¼	51½	54¾	57	59	60¾
37. Percentage.....percent.	17	17	14	12	17	13	14	15	23	26	25	28	28	21

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 24.—*Auxiliary proposed system of boys' body measurements based on intervals of height and hip measure (symbols, i. e., B<sub>1</sub>, B<sub>2</sub>, show corresponding intervals on fig. 12) and designated by approximate height and hip dimensions in inches—Continued*

Item No. and measurement	C <sub>14</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>	D <sub>8</sub>	D <sub>9</sub>	D <sub>10</sub>	D <sub>11</sub>	D <sub>12</sub>	D <sub>13</sub>	D <sub>14</sub>
	Height, 71; hip, 36	Height, 40½; hip, 23	Height, 43; hip, 23½	Height, 45½; hip, 24½	Height, 48; hip, 25;	Height, 50; hip, 26½	Height, 52½; hip, 27½	Height, 55; hip, 29	Height, 57; hip, 30	Height, 59½; hip, 32	Height, 62; hip, 33	Height, 64; hip, 35	Height, 66½; hip, 36½	Height, 69; hip, 37½	Height, 71; hip, 38
1. Waist height.....inches	45	24½	25¾	27½	29¼	30¾	32¼	34½	36½	37¾	39¾	40¾	41¾	43¾	45
2. Hip height.....do	36¾	19	20¾	21¾	23¾	24¾	26¾	27¾	29¾	30¾	32	33½	34¾	35¾	36¾
3. Weight.....pounds	143½	39½	44	48	53	60	67½	75	84	95½	108	123	138	151	158
4. Stature.....inches	70¾	40¾	43½	45¾	47¾	50	52¾	54¾	57	59¾	61¾	64¼	66½	68¾	70¾
5. Cervicale height.....do	60¾	33¾	35½	37½	39¾	41¾	43¾	46½	48¼	50¾	52¾	54¾	56¾	58¾	60¾
6. Tibiale height.....do	19¾	10½	11¼	12	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22¾
7. Crotch height.....do	33¼	16¾	18¼	19½	20¾	22¼	23¾	25	26¾	27¾	28¾	29¾	30¾	31¾	32¾
8. Bitrochanteric diameter.....do	13½	7¾	8¼	8½	8¾	9¼	9¾	10½	10¾	11¼	11¾	12¼	12¾	13¼	13¾
9. Shoulder slope.....degrees	25½	25½	26	26	25½	25½	25	25	25	25	25	25½	25	25	25½
10. Anterior chest width.....inches	13¾	8	8¼	8½	8¾	9¼	9¾	10½	10¾	11¼	11¾	12¼	12¾	13¼	13¾
11. Anterior waist length.....do	14	8¼	9¼	9½	9¾	10¼	10½	11	11¼	11½	12	12½	13	13½	14
12. Posterior chest width.....do	14½	9¼	9¾	10	10½	10¾	11¼	11½	11¾	12¾	12¾	13¾	14¾	15¾	16¾
13. Posterior waist length.....do	16¼	9½	10	10½	10¾	11¼	11½	12	12½	13	13¾	14½	15½	16¾	17¾
14. Chest girth at armsye.....do	35¼	22½	23¼	24¾	25¾	26¾	27¾	28¾	29¾	30¾	31¾	32¾	33¾	34¾	35¾
15. Scye depth.....do	7¾	4¾	4¾	5¾	5¾	6¼	6¼	6¼	6¼	6¼	6¼	6¼	6¼	6¼	6¼
16. Posterior hip arc.....do	17¾	11¾	11¾	12	12½	13	13¾	14¾	15½	16¼	17	17¾	18½	19¾	20¾
17. Maximum chest girth.....do	35¼				26	27	28	29	30¾	31¾	33¾	35¼	36¼	37¼	38¾
18. Anterior chest arc.....do	18¾	11¾	12¾	12¾	13	13½	14½	14¾	15¾	16¾	17	17¾	18¾	19¾	20¾
19. Waist girth.....do	28¼	20¾	21¼	21¾	21¾	22¼	23¼	23¾	24¾	25¾	26¾	27¾	28¾	29¾	30¾
20. Hip girth.....do	36¼	22¾	23¾	24¾	25¾	26¾	27¾	28¾	29¾	30¾	31¾	32¾	33¾	34¾	35¾
21. Neck-base girth.....do	16¼	11	11¾	11¾	11¾	12¼	12½	12¾	13¼	13¾	14¼	15¼	15¾	16¾	17¾
22. Shoulder length.....do	4¾	2¾	2¾	3	3¼	3¾	3¾	3¾	3¾	3¾	3¾	3¾	3¾	3¾	3¾
23. Armsye girth.....do	17	10¼	10¾	11	11½	11½	12½	13	13¾	14¾	15¾	16¾	17¾	18¾	19¾
24. Upper-arm girth.....do	10¾	6¾	6¾	7¼	7¼	7¼	7¾	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼
25. Elbow girth.....do	11½	7¼	7¼	7¾	8	8½	8¾	9	9¾	9¾	10¾	11	11¾	11¾	11¾
26. Upper posterior arm length.....do	14¾	8	8¼	9	9¼	10	10¾	11	11¾	12¼	12¾	13¾	14¾	15¾	16¾
27. Total posterior arm length.....do	26¼	14¼	15½	16	16¾	17¾	18¾	19¼	20¾	21¾	22¾	23¾	24¾	25¾	26¾
28. Trunk line.....do	8¼	4¾	5½	5¾	5¾	5¾	6	6¼	6¼	6¼	6¼	6¼	6¼	6¼	6¼
29. Waist to hips.....do	8½	5¾	5¾	5¾	5¾	6¼	6¾	6¾	6¾	6¾	6¾	6¾	6¾	6¾	6¾
30. Thigh girth.....do	20½	13¾	13¾	13¾	14¾	15½	16	16¾	17¾	18¾	19¾	20¾	21¾	22¾	23¾
31. Maximum calf girth.....do	13¼	8¾	9½	9¾	9¾	10¼	10¾	11¾	11¾	12¼	12¾	13¾	14¾	14¾	14¾
32. Knee girth.....do	14¼	9¼	9¾	9¾	10¼	10¾	11¾	11¾	12¼	12¾	13¾	14¾	14¾	14¾	14¾
33. Total crotch length.....do	29¾	18	18¾	19½	20¼	21	21¾	22¾	23¼	25¼	26¾	27¾	28¾	29¾	30¾
34. Anterior crotch length.....do	15¾	9	9¼	9¾	10½	10¾	11	11½	12	12¾	13¾	14¾	15¾	16¾	17¾
35. Extreme bend.....do	30¾	17¼	18¾	19¾	20	21¾	22¼	23¼	24¾	25½	26¾	27¾	28¾	29¾	30¾
36. Vertical trunk girth.....do	62¼	38	39½	41	42½	44¼	46	47¼	49¾	52	54¾	57¾	60¾	62¾	63¾
37. Percentage <sup>1</sup> .....percent	45	21	21	23	27	23	23	23	24	21	20	22	20	18	23

Item No. and measurement	E <sub>4</sub>	E <sub>5</sub>	E <sub>6</sub>	E <sub>7</sub>	E <sub>8</sub>	E <sub>9</sub>	E <sub>10</sub>	E <sub>11</sub>	E <sub>12</sub>	E <sub>13</sub>
	Height, 48; hip, 27	Height, 50; hip, 28	Height, 52½; hip, 29½	Height, 54½; hip, 31	Height, 57; hip, 32	Height, 59½; hip, 33½	Height, 62; hip, 35½	Height, 64; hip, 37	Height, 66½; hip, 38½	Height, 69; hip, 39½
1. Waist height.....inches	29¾	31	32¾	34¾	36¾	38	39½	40¾	42	43½
2. Hip height.....do	23¾	24¾	26½	27¾	29¾	30¾	32½	33¾	34¾	35¾
3. Weight.....pounds	58	65½	76	84½	94	106	120½	136	152½	165½
4. Stature.....inches	47¾	50¾	52¾	54¾	57¾	59¾	61¾	64¾	66½	68¾
5. Cervicale height.....do	39¾	41¾	44	46½	48¾	50¾	52¾	54¾	57	59
6. Tibiale height.....do	12¾	13¾	14¾	15¾	16	16¾	17¾	18	18½	19½
7. Crotch height.....do	20¾	22¾	23¾	25	26¾	27¾	28¾	29¾	30¾	31¾
8. Bitrochanteric diameter.....do	9½	9¾	10¼	10¾	11¾	11¾	12¾	12¾	13¾	13¾
9. Shoulder slope.....degrees	26	25	25	25	24½	24	24½	25	25	25
10. Anterior chest width.....inches	9¾	9¾	10½	10½	10¾	11¾	12	12¾	13¾	13¾
11. Anterior waist length.....do	10	10¾	11	11¾	12½	12½	13¾	14¾	15¾	16¾
12. Posterior chest width.....do	10½	10¾	11¾	12¾	12¾	13¾	14¾	15¾	16¾	17¾
13. Posterior waist length.....do	10¾	11¼	11¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾
14. Chest girth at armsye.....do	25½	26½	28½	29¼	30¼	31¾	33¾	35¾	37	38½
15. Scye depth.....do	5¾	5¾	5¾	6¼	6¼	6¼	6¼	6¼	6¼	6¼
16. Posterior hip arc.....do	13¾	13¾	14¾	15¼	15¾	16¾	17½	18½	19	19¾
17. Maximum chest girth.....do		26¼	28¼	29¼	30¾	31¾	33¾	35¾	37	38¼
18. Anterior chest arc.....do	13½	14½	15	15¾	16¼	17	17¾	18½	19½	20¼
19. Waist girth.....do	22½	23¼	24¾	25¾	26¾	27¾	28¾	29¾	30¾	31¾
20. Hip girth.....do	26¾	27¾	29¾	30¾	32½	33¾	35¾	36¾	38½	39½
21. Neck-base girth.....do	12¾	12¾	13¾	13¾	14¾	14¾	15¾	15¾	16¾	16¾
22. Shoulder length.....do	3¼	3¾	3¾	3¾	3¾	3¾	3¾	3¾	3¾	3¾
23. Armsye girth.....do	11¾	12¾	13¾	13¾	14¾	15	15¾	16½	17¾	17¾
24. Upper-arm girth.....do	7¾	8½	8¾	9	9¾	9¾	10¾	10¾	11¾	11¾
25. Elbow girth.....do	8¼	8¾	9½	9½	9¾	10¼	10¾	11¼	11¾	11¾
26. Upper posterior arm length.....do	9¾	10½	10¾	11¾	11¾	12¾	12¾	13¾	13¾	14¾
27. Total posterior arm length.....do	17	18	18¾	19¾	21	21¾	22¾	23¼	24¾	25¾
28. Trunk line.....do	5½	5¼	5¾	6¼	6¼	6¼	6¼	6¼	6¼	6¼
29. Waist to hips.....do	6	6¼	6¼	6¾	6¾	6¾	6¾	6¾	6¾	6¾
30. Thigh girth.....do	15½	16¾	17¾	18½	19¼	20¼	21½	22	22½	23¾
31. Maximum calf girth.....do	10¾	10¾	11¾	11¾	12¼	12¾	13½	14	14½	15
32. Knee girth.....do	10¾	11¼	11¾	12¾	12¾	13¾	14	14¾	15¾	15¾
33. Total crotch length.....do	20¾	21¾	22¾	23¾	24¾	26¼	27¾	28¾	29¾	30¾
34. Anterior crotch length.....do	10½	11	11¾	12	12½	13¾	14¾	15	15½	15½
35. Extreme bend.....do	20¾	21¾	22¾	23¾	24¾	26¼	27¾	28¾	29¾	30¾
36. Vertical trunk girth.....do	43¼	45¾	47½	48¾	49¾	50¾	52¾	55¼	58¼	61¾
37. Percentage <sup>1</sup> .....percent	3	4	4	5	6	6	6	6	5	4

<sup>1</sup> Based on total number of children in the given height interval.



TABLE 25.—Proposed system of girls' body measurements based on intervals of height and hip measure (symbols, i. e., C<sub>1</sub> C<sub>2</sub>, C<sub>3</sub>, show corresponding intervals on fig. 13) and designated by approximate height and hip dimensions in inches

Item No. and measurement	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>	C <sub>10</sub>	C <sub>11</sub>	C <sub>12</sub>
	Height, 40½; hip, 22	Height, 43; hip, 22½	Height, 45; hip, 23½	Height, 47½; hip, 24	Height, 50; hip, 25½	Height, 52; hip, 27	Height, 54½; hip, 28	Height, 57; hip, 30	Height, 59½; hip, 32	Height, 61½; hip, 34	Height, 64; hip, 35½	Height, 66; hip, 36½
1. Waist height.....inches	24½	26½	27½	29½	31½	32½	34½	36½	38	39½	40½	42½
2. Hip height.....do	19½	20½	22½	23½	25½	26½	28	29½	30½	31½	32½	34
3. Weight.....pounds	36	40	44	48	54	61	69	78	90	102	112½	122½
4. Stature.....inches	40½	42½	45½	47½	49½	52½	54½	56½	59½	61½	63½	66½
5. Cervicale height.....do	33½	35½	37½	39½	41½	43½	46	48½	50½	52½	54½	56½
6. Tibiale height.....do	10½	11½	12½	12½	13½	14½	15½	16½	17½	17½	18½	18½
7. Crotch height.....do	17½	18½	19½	21	22½	23½	25½	26½	27½	28½	29½	30½
8. Bitrochanteric diameter.....do	7½	8	8½	8½	9	9½	10	10½	11½	12	12½	13
9. Shoulder slope.....degrees	25½	25½	25½	25½	25½	25	25	25	25	25	25	25
10. Anterior chest width.....inches	7½	8	8½	8½	9	9½	10½	10½	10½	11½	11½	12½
11. Anterior waist length.....do	8½	8½	9½	9½	10	10½	10½	11	11½	12½	12½	13
12. Posterior chest width.....do	9½	9½	9½	10½	10½	10½	11½	11½	12½	12½	13	13½
13. Posterior waist length.....do	9½	9½	10½	10½	10½	11½	11½	12½	13½	13½	14½	14½
14. Chest girth at armscye.....do	21½	22½	23½	24½	24½	25½	26½	27½	29½	30½	32	32½
15. Scye depth.....do	4½	4½	5	5½	5½	5½	5½	6	6½	6½	7	7½
16. Posterior hip arc.....do	10½	11½	11½	12	12½	13½	14	14½	15½	16½	17½	18
17. Maximum chest girth.....do				23½	24½	25½	26½	27½	29½	31½	32½	33½
18. Anterior chest arc.....do				11½	12½	12½	13½	14½	15½	16½	17½	17½
19. Waist girth.....do	19½	19½	20½	20½	21½	21½	22½	23½	24½	24½	25½	25½
20. Hip girth.....do	21½	22½	23½	24½	25½	26½	28½	29½	31½	33½	35½	36½
21. Neck-hase girth.....do	10½	10½	11½	11½	11½	12	12½	12½	13½	13½	14½	14½
22. Shoulder length.....do	2½	2½	3½	3½	3½	3½	3½	3½	4½	4½	4½	4½
23. Armscye girth.....do	9½	10	10½	10½	11½	11½	12½	12½	13½	14½	14½	15
24. Upper-arm girth.....do	6½	6½	6½	6½	7	7½	7½	8½	8½	9	9½	9½
25. Elbow girth.....do	6½	7½	7½	7½	7½	8½	8½	9	9½	9½	9½	10½
26. Upper posterior arm length.....do	8	8½	9	9½	10	10½	11½	11½	11½	12½	13½	13½
27. Total posterior arm length.....do	14½	14½	15½	16½	17½	18½	19½	20½	21½	22½	23½	24½
28. Trunk line.....do	4½	5½	5½	5½	5½	6	6½	6½	6½	7½	7½	7½
29. Waist to hips.....do	5½	5½	5½	5½	6½	6½	6½	7½	7½	8	8½	8½
30. Thigh girth.....do	12½	13	13½	13½	14½	15½	16½	17½	18½	19½	20½	21½
31. Maximum calf girth.....do	8½	8½	9½	9½	9½	10½	10½	11½	11½	12½	12½	13½
32. Knee girth.....do	8½	9½	9½	9½	10½	11	11½	11½	12	12½	13½	13½
33. Total crotch length.....do	17½	18½	18½	19½	20½	21½	22½	23½	25	26½	27½	28½
34. Anterior crotch length.....do	8½	9	9½	9½	10½	10½	11½	11½	12½	12½	13½	13½
35. Extreme hend.....do	17½	18½	19½	20½	21½	22½	23½	24½	26½	27½	28½	29½
36. Vertical trunk girth.....do	36½	38½	39½	41	42½	44½	46½	48½	51½	53½	55½	57½
37. Percentage <sup>1</sup> .....percent	56	56	55	50	47	51	43	36	30	32	38	38

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 26.—Auxiliary proposed system of girls' body measurements based on intervals of height and hip measure (symbols, i. e., A<sub>8</sub>, B<sub>1</sub>, B<sub>2</sub>, show corresponding intervals on fig. 13) and designated by approximate height and hip dimensions in inches

Item No. and measurement	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>	A <sub>11</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
	Height, 56½; hip, 26½	Height, 59; hip, 28	Height, 61½; hip, 30	Height, 63½; hip, 32	Height, 40½; hip, 20½	Height, 42½; hip, 21½	Height, 45; hip, 22	Height, 47; hip, 23
1. Waist height.....inches	36½	37½	39½	40½	24½	25½	27½	29½
2. Hip height.....do	29½	30½	31½	33	19½	20½	22½	23½
3. Weight.....pounds	64	74	84	94	33	36½	40	44½
4. Stature.....inches	56½	58½	61½	63½	40½	42½	44½	47½
5. Cervicale height.....do	47½	50½	52½	54½	33½	35½	37½	39½
6. Tibiale height.....do	15½	16½	17½	17½	10½	11½	12	12½
7. Crotch height.....do	26½	27½	28½	29½	17½	18½	19½	21
8. Bitrochanteric diameter.....do	9½	10½	10½	11½	7½	7½	7½	8½
9. Shoulder slope.....degrees	25	24½	24½	25	25½	25	25	25
10. Anterior chest width.....inches	9½	10½	10½	11½	7½	7½	8½	8½
11. Anterior waist length.....do	10½	11½	11½	12½	8½	8½	9½	9½
12. Posterior chest width.....do	11½	11½	12	12½	8½	9½	9½	10
13. Posterior waist length.....do	12½	12½	13½	14	9½	9½	10	10½
14. Chest girth at armscye.....do	25½	27½	29½	29½	20½	21½	22½	22½
15. Scye depth.....do	5½	6½	6½	6½	4½	4½	4½	5
16. Posterior hip arc.....do	13	13½	14½	15½	10½	10½	10½	11½
17. Maximum chest girth.....do	23½	27½	28½	29½	20½	21½	22½	22½
18. Anterior chest arc.....do	13½	14½	15	15½	10½	11½	11½	11½
19. Waist girth.....do	23½	23½	23½	23½	18½	19	19½	19½
20. Hip girth.....do	26½	28½	30½	31½	20½	21½	22½	22½
21. Neck-hase girth.....do	12½	12½	13½	13½	10½	10½	10½	11
22. Shoulder length.....do	3½	3½	4½	4½	2½	2½	3	3½
23. Armscye girth.....do	11½	12½	13½	13½	9½	9½	10	10½
24. Upper-arm girth.....do	7½	7½	7½	8½	6	6	6½	6½
25. Elbow girth.....do	8½	8½	9½	9½	6½	6½	7	7½
26. Upper posterior arm length.....do	11½	12	12½	13½	7½	8½	8½	9½
27. Total posterior arm length.....do	20½	21½	22½	23	13½	14½	15½	16½
28. Trunk line.....do	6½	6½	7½	7½	4½	5½	5½	5½
29. Waist to hips.....do	6½	7½	7½	8½	5½	5½	5½	5½
30. Thigh girth.....do	14½	15½	16½	17½	11½	12½	12½	13
31. Maximum calf girth.....do	10½	10½	11½	11½	8½	8½	8½	9
32. Knee girth.....do	11	11½	12½	12½	8½	8½	9½	9½
33. Total crotch length.....do	22½	23½	24½	25½	17	17½	18½	19½
34. Anterior crotch length.....do	11	11½	12½	12½	8½	8½	9½	9½
35. Extreme hend.....do	24	25	26½	27½	17	17½	18½	19½
36. Vertical trunk girth.....do	46½	48½	51	53	36½	37½	38½	40½
37. Percentage <sup>1</sup> .....percent	4	7	7	6	25	23	19	17

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 26.—Auxiliary proposed system of girls' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $A_8$ ,  $B_1$ ,  $B_2$ , show corresponding intervals on fig. 13) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$B_5$	$B_6$	$B_7$	$B_8$	$B_9$	$B_{10}$	$B_{11}$	$B_{12}$
	Height, 49½; hip, 24	Height, 52; hip, 25	Height, 54½; hip, 26½	Height, 57; hip, 28	Height, 59; hip, 30	Height, 61½; hip, 32	Height, 64; hip, 33½	Height, 66; hip, 35
1. Waist height.....inches	31	32¾	34½	36¼	37¾	39¼	40¾	42½
2. Hip height.....do	25	29¾	28	29¾	30¾	31¾	32¾	34½
3. Weight.....pounds	49½	55½	63	71	81½	92½	103	112
4. Stature.....inches	49½	51¾	53¾	56¾	59½	61½	63¾	66
5. Cervicale height.....do	41¾	43½	45¾	48	50¼	52½	54½	56½
6. Tibiale height.....do	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾
7. Crotch height.....do	22¾	23¾	25¾	26¾	27¾	28¾	29¾	30¾
8. Bitrochanteric diameter.....do	8¾	9	9½	10	10¾	11½	12	12½
9. Shoulder slope.....degrees	25	25	25	25	25	25	25	25½
10. Anterior chest width.....inches	8¾	9¼	9¾	10	10½	11	11½	11¾
11. Anterior waist length.....do	9¾	10¼	10¾	10¾	10¾	11¾	12¾	12¾
12. Posterior chest width.....do	10¼	10¾	11	11½	11¾	12¾	12¾	13¾
13. Posterior waist length.....do	10¾	11¼	11¾	12¼	12¾	13¾	14¼	14¾
14. Chest girth at armseye.....do	23¾	24½	25¾	26¾	28¼	29½	30¾	31½
15. Scye depth.....do	5¼	5½	5¾	5¾	6¼	6½	6¾	7¼
16. Posterior hip arc.....do	11¾	12¾	13¼	13¾	14¾	15¾	16¼	17¼
17. Maximum chest girth.....do	23¾	24¾	25¾	26¾	28¼	29½	31¼	32¾
18. Anterior chest arc.....do	12¾	12¾	13¼	14¼	14¾	15¾	16¾	16¾
19. Waist girth.....do	20¼	20¾	21½	22¾	23¾	23¾	24¾	24¾
20. Hip girth.....do	24	25½	26¾	28¼	30	32	33¾	34¾
21. Neck-hase girth.....do	11¾	12¼	12¾	13	13	13½	14	14¾
22. Shoulder length.....do	3¾	3½	3¾	3¾	4	4½	4¾	4¾
23. Armseye girth.....do	10¾	11¼	11¾	12¾	13	13¾	14¼	14¾
24. Upper-arm girth.....do	6¾	6¾	7¼	7¾	8	8¾	8¾	9
25. Elbow girth.....do	7½	7¾	8¼	8¾	9	9¾	9¾	9¾
26. Upper posterior arm length.....do	9¾	10½	11	11¾	12¾	13¼	13¼	13¾
27. Total posterior arm length.....do	17¾	18¾	19¾	20¾	21¾	22¼	23¼	24
28. Trunk line.....do	5¾	6	6¼	6½	6¾	7¼	7½	7¾
29. Waist to hips.....do	6¾	6¾	6¾	7	7¾	7¾	8¼	8¼
30. Thigh girth.....do	13¾	14¼	15½	16	17	18¾	19	19¾
31. Maximum calf girth.....do	9¾	9¾	10¼	10¾	11¼	11¾	12¼	12¾
32. Knee girth.....do	10	10¾	10¾	11½	12	12½	12¾	13¾
33. Total crotch length.....do	20	20¾	21¾	22¾	24¼	25¼	26¾	27¾
34. Anterior crotch length.....do	10	10¾	10¾	11¾	11¾	12¾	13	13½
35. Extreme bend.....do	21	22¼	23¼	24½	25¾	26¾	28	29
36. Vertical trunk girth.....do	41¾	43¾	45¾	47¾	49¾	52¼	54½	56¼
37. Percentage <sup>1</sup> .....percent	19	21	29	30	26	20	21	25

Item No. and measurement	$D_1$	$D_2$	$D_3$	$D_4$	$D_5$	$D_6$	$D_7$	$D_8$	$D_9$	$D_{10}$	$D_{11}$	$D_{12}$
	Height, 41; hip, 23½	Height, 43; hip, 24	Height, 45½; hip, 25	Height, 47½; hip, 25½	Height, 50; hip, 27	Height, 52; hip, 28½	Height, 54½; hip, 30	Height, 57; hip, 32	Height, 59½; hip, 34	Height, 62; hip, 36	Height, 64; hip, 37	Height, 66; hip, 38½
1. Waist height.....inches	24¾	26¼	27¾	29¾	31¾	33¾	34¾	36½	38	39¼	40¾	42¼
2. Hip height.....do	19½	20¾	22¼	23¾	25¾	28¼	29¾	30¾	30¾	31½	32¾	34
3. Weight.....pounds	39½	43½	48	53	59	68	77½	87½	99½	112	123½	134
4. Stature.....inches	40¾	43	45¾	47¾	50	52¼	54¾	57	59½	61¾	64	66½
5. Cervicale height.....do	33¾	35¾	37¾	39¾	41¾	44	46¼	48½	50¾	52¾	54¾	56¾
6. Tibiale height.....do	10¾	11½	12¼	13	13¾	14½	15¼	16	16½	17	17¾	18¾
7. Crotch height.....do	17	18¾	19¾	21	22¾	23¾	25	26	27½	28	29¾	30¾
8. Bitrochanteric diameter.....do	8	8¾	9	9¾	9¾	10½	11½	11¾	12¾	12¾	13¾	13¾
9. Shoulder slope.....degrees	26	25½	26	26	25½	25½	25	25	25	24	24½	24½
10. Anterior chest width.....inches	8	8¼	8¾	8¾	9¾	9¾	10¼	10¾	11¼	11¼	11¾	12¼
11. Anterior waist length.....do	8¾	9	9¾	9¾	10	10¾	10¾	11¼	11¾	12¼	12¾	13¾
12. Posterior chest width.....do	9¾	9¾	10	10¼	10¾	11	11½	12	12½	12¾	13¼	13¾
13. Posterior waist length.....do	9¾	9¾	10¼	10¾	11	11¾	11¾	12½	13¾	14	14¾	14¾
14. Chest girth at armseye.....do	22¾	22¾	23¾	24¾	25¼	26½	27¾	29¼	30¾	32½	33¾	34
15. Scye depth.....do	4¾	4¾	5	5¼	5¾	5¾	6	6¾	6¾	6¾	7¼	7½
16. Posterior hip arc.....do	11¾	11¾	12¾	12¾	13¾	14¾	15	15¾	16¾	17¾	18¼	19
17. Maximum chest girth.....do	11¾	12	12¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾
18. Anterior chest arc.....do	11¾	12	12¾	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾
19. Waist girth.....do	20¾	20¾	21	21¾	22	23¾	24	24¾	25	25¾	26¾	26¾
20. Hip girth.....do	23½	24	24¾	25¾	26¾	28¼	30¾	31¾	33¾	35¾	37¼	38½
21. Neck-hase girth.....do	10¾	11¾	11¾	11¾	11¾	12¼	12¾	13¾	13¾	14¾	14¾	14¾
22. Shoulder length.....do	27¾	3	3¾	3¼	3¼	3¾	3¾	4	4½	4¾	4¾	4¾
23. Armseye girth.....do	10¾	10¾	10¾	11	11½	12½	12¾	13¾	14	14¾	15	15½
24. Upper-arm girth.....do	6¾	7	7¾	7¼	7½	8	8½	8¾	9¼	9¾	10	10¼
25. Elbow girth.....do	7½	7¾	7¾	7¾	8	8½	8¾	9¼	9¾	9¾	10¼	10¼
26. Upper posterior arm length.....do	8	8½	9	9½	10	10¾	11¼	11¾	12¾	12¾	13¾	13¾
27. Total posterior arm length.....do	14½	15	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22½	23¾	24¼
28. Trunk line.....do	4¾	5	5¼	5½	5¾	5¾	6	6¾	6¾	7¼	7¼	7¾
29. Waist to hips.....do	5¾	5½	5¾	6	6¾	6¾	7	7¾	7¾	8¼	8¼	8¾
30. Thigh girth.....do	13½	14	14½	14¾	15¾	16¾	17¾	18¾	19¾	20¾	21¾	22¾
31. Maximum calf girth.....do	8¾	9¼	9¾	9¾	10¼	10¾	11¾	11¾	12¾	13	13¾	13¾
32. Knee girth.....do	9¼	9¾	10	10¾	10¾	11¾	12	12½	12¾	13¾	13¾	14¾
33. Total crotch length.....do	18¾	18¾	19½	20¾	21¼	22½	23¾	24¾	26	27	28½	29
34. Anterior crotch length.....do	9	9¼	9¾	10	10½	11¾	11¾	12½	12¾	13¾	13¾	14¼
35. Extreme bend.....do	17¾	18¾	19¾	20¾	21¾	23	24¼	25¾	26¾	27¾	28¾	29¾
36. Vertical trunk girth.....do	37¾	39¾	40¾	41¾	43¾	45¾	47¾	50	52¾	55	57	58¾
37. Percentage <sup>1</sup> .....percent	17	18	21	26	24	21	18	19	21	26	24	22

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 26.—Auxiliary proposed system of girls' body measurements based on intervals of height and hip measure (symbols, i. e.,  $A_s$ ,  $B_1$ ,  $B_2$ , show corresponding intervals on fig. 13) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$E_3$	$E_4$	$E_5$	$E_6$	$E_7$	$E_8$	$E_9$	$E_{10}$	$E_{11}$
	Height, 45½; hip, 26½	Height, 47½; hip, 27	Height, 50; hip, 28½	Height, 52½; hip, 30½	Height, 55; hip, 32	Height, 57; hip, 34	Height, 59½; hip, 36	Height, 62; hip, 37½	Height, 64½; hip, 39
1. Waist height.....inches	28	29¾	31½	33¾	35½	36¾	37¾	39¾	40¾
2. Hip height.....do	22¼	23¾	25¼	26¾	28¼	29¾	30¼	31¾	32¾
3. Weight.....pounds	53	58	65½	77	87	97½	109½	123	136
4. Stature.....inches	45½	47½	50	52½	55	57	59½	62	64½
5. Cervicale height.....do	37¾	39¾	42	44¾	46¾	48¾	50¾	52¾	54¾
6. Tibiale height.....do	12¾	13¾	14¾	15¾	16¾	17¾	18¾	19¾	20¾
7. Crotch height.....do	19¾	21	22¾	23¾	24¾	26	27¾	29	29¾
8. Bitrochanteric diameter.....do	9½	9¾	10	10½	11	11¾	12¾	13¾	14¾
9. Shoulder slope.....degrees	26	26	25½	25½	24½	24½	24½	24	24½
10. Anterior chest width.....inches	8¾	9¼	9¾	10¾	10¾	11¾	11¾	12¾	12¾
11. Anterior waist length.....do	9½	9¾	10¼	10¾	10¾	11¾	11¾	12¾	12¾
12. Posterior chest width.....do	10½	10¾	10¾	11¾	11¾	12¾	12¾	13¾	13¾
13. Posterior waist length.....do	10½	10¾	11	11¾	11¾	12¾	12¾	13¾	13¾
14. Chest girth at armseye.....do	24½	25¼	26¼	28¼	29¾	30¾	32¼	33½	34½
15. Scye depth.....do	5½	5¾	5¾	5¾	6	6¾	6¾	7	7¼
16. Posterior hip arc.....do	13¾	13¾	14¼	15¼	16	16¾	17¾	18¾	19¾
17. Maximum chest girth.....do	—	25¾	23¾	28¾	29¼	31	32¼	34¼	35¼
18. Anterior chest arc.....do	13	13¾	14	14¾	15¾	16¾	17¾	18	18¾
19. Waist girth.....do	22¼	22¼	23¼	24¾	25¾	26¾	27¾	28¾	29¾
20. Hip girth.....do	26¾	27¼	28¾	30¾	32¾	33¾	35¾	37¾	39¼
21. Neck-base girth.....do	11¼	11¾	12¼	12¾	13	13¾	14	14¾	15¼
22. Shoulder length.....do	31¼	31¾	32¾	33¾	34¾	35¾	36¾	37¾	38¾
23. Armseye girth.....do	11¼	11¾	12	12¾	13¾	14	14¾	15¾	16¾
24. Upper-arm girth.....do	7¾	7¾	8	8¾	9¾	9¾	9¾	10¾	10¾
25. Elbow girth.....do	7¾	8	8	8¾	9¾	9¾	9¾	10¾	10¾
26. Upper posterior arm length.....do	9¾	9¾	10¼	10¾	11¼	11¾	12¾	12¾	13¾
27. Total posterior arm length.....do	16	16¾	17¾	18¾	19¾	20¾	21¾	22¾	23¾
28. Trunk line.....do	5¼	5¾	5¾	5¾	6¾	6¾	6¾	7¾	7¾
29. Waist to hips.....do	5¾	6¼	6¼	6¾	7¾	7¾	7¾	8¾	8¾
30. Thigh girth.....do	15¾	16	17	18¾	19¾	20	21	22¼	23¾
31. Maximum calf girth.....do	10	10¾	10¾	11¾	11¾	12¾	13	13¾	14
32. Knee girth.....do	10½	10¾	11¼	12	12¾	13	13¾	14¾	14¾
33. Total crotch length.....do	20¼	21	22¼	23¾	24¾	25¾	26¾	27¾	29
34. Anterior crotch length.....do	9¾	10¾	10¾	11¾	12¾	12¾	13¾	13¾	14¾
35. Extreme bend.....do	20	21	22¼	23¾	24¾	25¾	27	28¾	29¼
36. Vertical trunk girth.....do	41¼	42¾	44¾	47	49	51½	54	56¼	58¾
37. Percentage <sup>1</sup> .....percent	3	6	6	7	6	7	12	11	8

<sup>1</sup> Based on total number of children in the given height interval.

A study of tables 23 to 26 shows that for a given height interval, the change in the linear measurements from one size to another is very slight. This only bears out the analysis, which showed that for a constant height, a girth contributes very little to the prediction of a length. These tables also indicate, in some instances, a slight decrease in the mean lengths, as one proceeds in the same stature interval from a small mean hip size to a larger mean hip size. These phenomena might be explained by a study of table 10. This table shows, in general, negative correlations between linear measurements and girths when stature is held constant.

The means given in tables 23, 24, 25, and 26 do not, of course, completely describe the distribution of the

measurements within a given height-hip interval (rectangle). A knowledge of the variations of these measurements around their respective averages is also required. To supply this, tables 27 and 28 are presented. In these tables the numbers in columns 1 and 2 define the rectangles found in figures 12 and 13. For example, the numbers 100–105.9 given in column 1 of table 27 define the horizontal side of rectangle  $B_1$  (fig. 12), while the numbers 49–52.9 define the vertical side of the same rectangle. These tables give the mean and standard deviation (in inches) for each height-hip interval for five important measurements. They also give the number of cases in each of the height-hip intervals on which the calculations of the sizes were based.

TABLE 27.—Means and standard deviations of 5 measurements for stature and hip-girth intervals for boys

Stature interval (centimeters)	Hip-girth interval	Number of cases	Hip height		Chest girth		Waist girth		Total arm length		Vertical trunk girth	
			Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
			<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
100-105.9	49-52.9	111	19.0	0.66	21.2	0.72	19.2	0.76	13.9	0.56	36.4	1.08
	53-56.9	389	19.1	.66	21.9	.78	19.9	.78	14.1	.51	37.3	1.19
	57-60.9	134	19.0	.71	22.6	.74	20.8	.75	14.3	.56	38.0	1.19
106-111.9	51-54.9	287	20.4	.63	21.9	.76	19.6	.82	14.8	.53	37.9	1.13
	55-58.9	1,039	20.5	.68	22.6	.76	20.3	.88	15.0	.54	38.7	1.15
	59-62.9	359	20.6	.68	23.2	.77	21.2	.84	15.2	.50	39.5	1.10
112-117.9	53-56.9	488	21.8	.69	22.6	.76	20.0	.80	15.7	.56	39.3	1.17
	57-60.9	2,055	21.9	.70	23.3	.77	20.8	.85	15.9	.57	40.2	1.11
	61-64.9	793	21.9	.67	23.9	.81	21.5	.86	16.0	.56	41.0	1.04
118-123.9	55-58.9	619	23.1	.72	23.2	.78	20.4	.81	16.5	.56	40.8	1.16
	59-62.9	2,956	23.3	.71	24.0	.80	21.9	.71	16.7	.58	41.6	1.13
	63-66.9	1,401	23.4	.70	24.7	.83	21.9	.85	16.9	.59	42.5	1.11
	67-70.9	157	23.4	.76	25.5	.91	22.8	1.01	17.0	.60	43.3	1.13
124-129.9	58-61.9	1,106	24.7	.71	24.2	.83	21.0	.86	17.5	.59	42.4	1.15
	62-65.9	3,510	24.8	.73	24.9	.84	21.7	.87	17.7	.58	43.3	1.13
	66-69.9	1,523	24.8	.73	25.7	.87	22.6	.82	17.8	.58	44.2	1.12
	70-73.9	251	24.9	.75	26.5	.98	23.7	1.02	18.0	.60	45.2	1.20
130-135.9	59-63.9	953	26.2	.73	24.9	.86	21.4	.84	18.4	.62	43.7	1.16
	64-68.9	4,503	26.3	.77	25.8	.89	22.3	.90	18.6	.47	44.9	1.19
	69-73.9	1,731	26.4	.77	26.8	.94	23.3	.97	18.8	.62	46.0	1.16
	74-78.9	284	26.5	.73	28.1	1.20	24.8	1.28	18.9	.67	47.2	1.29
136-141.9	62-66.9	1,175	27.7	.79	25.8	.92	22.0	.88	19.4	.65	45.4	1.14
	67-71.9	4,700	27.8	.78	26.8	.96	22.9	.90	19.6	.65	46.6	1.22
	72-76.9	1,898	27.9	.78	27.8	1.01	23.9	.98	19.3	.65	47.7	1.23
	77-81.9	381	27.9	.78	29.2	1.13	25.7	1.29	19.9	.66	48.9	1.29
142-147.9	65-69.9	1,168	29.3	.81	26.8	1.01	22.6	.91	20.4	.66	47.2	1.28
	70-74.9	4,095	29.3	.77	27.8	.99	23.6	.92	20.6	.65	48.4	1.30
	75-79.9	1,900	29.4	.80	28.9	1.07	24.7	1.06	20.8	.66	49.6	1.33
	80-84.9	502	29.4	.81	30.3	1.24	26.4	1.37	20.9	.68	50.9	1.43
148-153.9	69-73.9	1,482	30.8	.79	28.0	1.06	23.4	.94	21.4	.70	49.2	1.30
	74-78.9	2,985	30.8	.80	29.1	1.09	24.4	.97	21.6	.68	50.6	1.40
	79-83.9	1,336	30.8	.84	30.4	1.15	25.7	1.11	21.7	.68	52.0	1.45
	84-88.9	391	30.8	.84	31.8	1.20	27.6	1.57	21.9	.66	53.1	1.56
154-159.9	73-77.9	1,316	32.3	.80	29.3	1.10	24.4	.96	22.4	.66	51.5	1.46
	78-82.9	2,222	32.2	.84	30.6	1.17	25.4	.97	22.5	.71	53.1	1.55
	83-87.9	1,022	32.0	.90	31.9	1.31	26.7	1.15	22.7	.70	54.7	1.73
	88-92.9	289	32.1	.88	33.4	1.45	28.7	1.66	22.8	.69	55.8	1.69
160-165.9	77-81.9	1,191	33.6	.87	30.8	1.26	25.2	1.05	23.3	.70	54.3	1.63
	82-86.9	2,024	33.3	.89	32.4	1.36	26.3	1.06	23.5	.75	56.0	1.66
	87-91.9	1,063	33.1	.94	33.9	2.19	27.6	1.22	23.7	.69	57.7	1.81
	92-96.9	269	33.1	1.01	35.1	1.63	29.5	1.59	23.7	.74	58.7	1.92
166-171.9	81-85.9	1,329	34.6	.95	32.4	1.37	26.1	1.03	24.3	.74	57.1	1.63
	86-90.9	2,352	34.4	.92	34.1	1.46	27.2	1.05	24.4	.72	58.7	1.72
	91-95.9	1,085	34.2	.96	35.7	1.48	28.6	1.27	24.6	.75	60.2	1.78
	96-100.9	273	34.3	.94	37.0	1.58	30.7	1.59	24.7	.70	61.3	1.74
172-177.9	84-88.9	1,179	35.7	.92	33.7	1.42	26.7	1.06	25.2	.72	59.4	1.67
	89-93.9	1,837	35.5	.93	35.2	1.42	27.9	1.14	25.2	.73	60.8	1.61
	94-98.9	743	35.4	.90	36.7	1.42	29.4	1.25	25.4	.72	62.2	1.61
	99-103.9	175	35.4	1.02	38.2	1.52	31.4	1.62	25.6	.77	63.5	1.73
178-183.9	85-89.9	415	36.9	.92	34.3	1.27	27.0	1.57	25.9	.74	60.7	1.69
	90-94.9	902	36.8	.96	35.7	1.46	28.1	1.63	26.1	.75	62.1	1.78
	95-99.9	458	36.6	.94	37.2	1.36	29.5	1.60	26.2	.93	63.6	1.72

TABLE 28.—Means and standard deviations of 5 measurements for stature and hip-girth intervals for girls

Stature interval (centimeters)	Hip girth interval	Number of cases	Hip height		Chest girth		Waist girth		Total arm length		Vertical trunk girth	
			Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
	<i>Centimeters</i>		<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
100-105.9	50-53.9	235	19.2	0.72	20.9	0.63	18.8	0.90	13.9	0.58	36.1	1.10
	54-57.9	519	19.3	.68	21.7	.72	19.5	.80	14.1	.66	36.9	1.08
	58-61.9	155	19.5	.71	22.4	.75	20.4	.83	14.2	.56	37.7	1.00
106-111.9	52-55.9	523	20.6	.75	21.6	.75	19.0	.86	14.7	.57	37.4	1.12
	56-59.9	1,279	20.8	.70	22.2	.72	19.8	.82	14.9	.54	38.2	1.14
	60-63.9	400	20.8	.68	22.9	.74	20.7	.86	15.0	.54	39.1	1.09
112-117.9	54-57.9	789	22.1	.66	22.2	.76	19.4	.83	15.6	.56	38.9	1.15
	58-61.9	2,232	22.2	.71	22.8	.78	20.1	.87	15.8	.57	39.6	1.08
	62-65.9	852	22.3	.70	23.6	.84	21.0	.89	15.9	.52	40.4	1.03
	66-69.9	140	22.3	.73	24.6	.90	22.3	1.04	16.0	.53	41.1	1.02
118-123.9	56-59.9	948	23.4	.71	22.9	.76	19.7	.81	16.4	.57	40.2	1.10
	60-63.9	2,842	23.6	.72	23.5	.80	20.5	.85	16.6	.57	41.1	1.15
	64-67.9	1,470	23.7	.71	24.3	.86	21.4	.90	16.8	.60	41.9	1.09
	68-71.9	332	23.8	.70	25.2	1.01	22.5	1.02	16.9	.54	42.6	1.19
124-129.9	59-62.9	1,267	25.0	.74	23.7	.83	20.3	.83	17.4	.59	41.9	1.15
	63-66.9	3,118	25.1	.74	24.4	.85	21.1	.87	17.6	.59	42.7	1.16
	67-70.9	1,603	25.1	.74	25.2	.89	22.0	.95	17.7	.60	43.5	1.11
	71-74.9	423	25.2	.81	26.3	.94	23.3	1.10	17.8	.59	44.5	1.26
130-135.9	61-65.9	1,476	26.4	.77	24.5	.87	20.9	.86	18.4	.62	43.6	1.20
	66-70.9	3,532	26.6	.77	25.4	.91	21.8	.97	18.5	.62	44.5	1.20
	71-75.9	1,422	26.6	.77	26.5	1.03	23.1	1.07	18.7	.63	45.6	1.22
	76-80.9	358	26.7	.81	28.1	1.23	24.9	1.37	18.8	.65	47.0	1.28
136-141.9	65-69.9	1,942	28.0	.76	25.6	.92	21.5	.93	19.4	.63	45.4	1.23
	70-74.9	2,878	28.0	.79	26.5	.97	22.6	.99	19.5	.63	46.5	1.29
	75-79.9	1,201	28.3	.82	27.9	1.12	24.1	1.23	19.7	.64	47.7	1.24
	80-84.9	369	28.1	.85	29.4	1.29	25.9	1.52	19.8	.74	49.0	1.31
142-147.9	64-68.9	264	29.3	.85	25.8	.91	21.4	.90	20.2	.66	46.2	1.41
	69-73.9	1,789	29.4	.77	26.7	1.01	22.3	.99	20.4	.66	47.6	1.26
	74-78.9	2,162	29.4	.81	27.8	1.05	23.4	1.08	20.6	.66	48.6	1.35
	79-83.9	1,111	29.3	.81	29.2	1.21	24.8	1.34	20.6	.65	50.0	1.39
	84-88.9	410	29.4	.92	30.8	1.41	26.2	1.80	20.9	.70	51.5	1.40
	89-93.9	150	29.3	.94	32.5	1.58	27.7	2.07	21.0		52.9	
148-153.9	69-73.9	472	30.7	.77	27.1	1.07	22.4	.97	21.2	.64	48.7	1.52
	74-78.9	1,750	30.7	.79	28.1	1.03	23.2	.99	21.4	.67	49.8	1.33
	79-83.9	2,013	30.6	.87	29.3	1.15	24.2	1.16	21.5	.70	51.2	1.37
	84-88.9	1,437	30.4	.92	30.8	1.33	25.0	1.50	21.7	.67	52.7	1.44
	89-93.9	783	30.3	.90	32.2	1.37	26.1	1.71	21.8	.70	54.0	1.40
154-159.9	74-78.9	565	31.9	.84	28.4	1.20	23.2	1.13	22.2	.72	51.0	1.47
	79-83.9	1,686	31.8	.87	29.6	1.13	23.9	1.08	22.3	.70	52.3	1.41
	84-88.9	2,740	31.5	.90	30.9	1.23	24.6	1.21	22.4	.69	53.8	1.51
	89-93.9	2,160	31.5	.94	32.1	1.32	25.6	1.43	22.5	.72	55.0	1.44
	94-98.9	943	31.4	.91	33.5	1.45	26.9	1.68	22.6	.70	56.3	1.51
160-165.9	78-82.9	380	33.0	.95	29.7	1.20	23.6	1.03	23.0	.81	53.2	1.50
	83-87.9	1,427	32.9	.92	30.8	1.20	24.3	1.11	23.1	.70	54.5	1.40
	88-92.9	2,533	32.7	.91	32.0	1.25	25.1	1.17	23.3	.70	55.8	1.46
	93-97.9	1,588	32.7	.93	33.1	1.32	26.2	1.37	23.3	.71	57.0	1.46
	98-102.9	560	32.6	.93	34.5	1.78	27.8	1.74	23.5	.72	58.1	1.57
166-171.9	86-90.9	616	34.1	1.00	31.5	1.16	24.7	1.15	24.0	.76	56.3	1.54
	91-95.9	961	34.0	.91	32.8	1.31	25.7	1.17	24.1	.74	57.5	1.51
	96-100.0	563	34.0	.98	34.0	1.43	26.8	1.45	24.2	.75	58.6	1.57

At the suggestion of the committee (p. III) of manufacturers, retailers, and consumers, sponsored by the American Standards Association to study the formulation of a standard system of sizing, the sample was divided into two groups, by States. A set of sizes was calculated from the measurements of each group, following the same procedure used for the entire sample. The purpose was to determine whether the proposed body dimensions differed between the two groups. Group 1 consisted of measurements taken in the District of Columbia, Illinois, Maryland, Michigan, Ohio, Pennsylvania, and Virginia. Group 2 consisted of

measurements taken in the remaining 10 States, namely: Alabama, California, Colorado, Iowa, Kansas, Minnesota, Nebraska, Tennessee, Texas, and Utah.

The means for each height-girth of hips interval for two measurements, chest girth and hip height, were calculated for each of the groups and are presented in tables 29 and 30. These tables also give the number of cases in each height-hip interval for each group. It will be seen that the means of the two measurements for the two groups of States do not differ greatly,<sup>25</sup> and

<sup>25</sup> Whether the differences between the means are statistically significant cannot be ascertained since no measure of the variability was calculated.

that the central rectangles remain modal for both groups. That is, the great majority of cases fall in the central rectangles for either group. These facts may indicate that if height and hip girth are used as controls the essential features of the sizing scheme will not be greatly altered by regional differences.

TABLE 29.—Mean chest girth and mean hip height for each height-hip girth interval for boys in 2 groups of States

Stature interval (centimeters)	Hip girth interval (centimeters)	Means in inches for—				Number of cases	
		Hip height		Chest girth		Group I <sup>1</sup>	Group II <sup>2</sup>
		Group I <sup>1</sup>	Group II <sup>2</sup>	Group I <sup>1</sup>	Group II <sup>2</sup>		
100-105.9	49-52.9	19	19	21 $\frac{1}{4}$	21 $\frac{1}{4}$	37	74
	53-56.9	19	19 $\frac{1}{2}$	22	21 $\frac{1}{4}$	104	285
	57-60.9	19	19 $\frac{1}{2}$	22 $\frac{1}{4}$	22 $\frac{1}{2}$	36	98
106-111.9	51-54.9	20 $\frac{3}{8}$	20 $\frac{1}{2}$	21 $\frac{3}{4}$	22	80	207
	55-58.9	20 $\frac{1}{2}$	20 $\frac{3}{4}$	22 $\frac{3}{4}$	22 $\frac{1}{2}$	296	743
	59-62.9	20 $\frac{1}{2}$	20 $\frac{5}{8}$	23 $\frac{1}{4}$	23 $\frac{1}{4}$	88	271
112-117.9	53-56.9	21 $\frac{3}{8}$	21 $\frac{3}{4}$	22 $\frac{3}{8}$	22 $\frac{1}{2}$	147	341
	57-60.9	21 $\frac{3}{8}$	21 $\frac{3}{4}$	23 $\frac{1}{4}$	23 $\frac{1}{4}$	622	1,433
	61-64.9	21 $\frac{3}{8}$	22	24	23 $\frac{3}{4}$	254	539
118-123.9	55-58.9	23 $\frac{1}{4}$	23 $\frac{1}{8}$	23 $\frac{1}{4}$	23 $\frac{1}{8}$	207	412
	64-68.9	23 $\frac{3}{8}$	23 $\frac{1}{4}$	24	24	952	2,004
	63-66.9	23 $\frac{3}{8}$	23 $\frac{3}{8}$	24 $\frac{3}{8}$	24 $\frac{3}{8}$	492	909
124-129.9	67-70.9	23 $\frac{3}{8}$	23 $\frac{3}{8}$	25 $\frac{3}{8}$	25 $\frac{1}{2}$	48	109
	58-61.9	24 $\frac{3}{4}$	24 $\frac{3}{8}$	24 $\frac{1}{4}$	24 $\frac{1}{8}$	338	768
	62-65.9	24 $\frac{3}{8}$	24 $\frac{3}{8}$	25	24 $\frac{1}{2}$	1,155	2,355
130-135.9	66-69.9	24 $\frac{3}{8}$	24 $\frac{3}{8}$	25 $\frac{3}{4}$	25 $\frac{3}{8}$	539	984
	70-73.9	25	24 $\frac{3}{8}$	26 $\frac{3}{8}$	26 $\frac{1}{2}$	91	160
	59-63.9	26 $\frac{1}{4}$	26 $\frac{1}{8}$	24 $\frac{3}{8}$	24 $\frac{3}{8}$	323	630
136-141.9	64-68.9	26 $\frac{3}{8}$	26 $\frac{1}{4}$	25 $\frac{3}{8}$	25 $\frac{1}{2}$	1,496	3,007
	69-73.9	26 $\frac{1}{2}$	26 $\frac{3}{8}$	26 $\frac{3}{8}$	26 $\frac{3}{4}$	642	1,089
	74-78.9	26 $\frac{3}{8}$	26 $\frac{1}{2}$	28 $\frac{1}{4}$	28 $\frac{1}{8}$	105	179
142-147.9	62-66.9	27 $\frac{3}{4}$	27 $\frac{3}{8}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$	380	795
	67-71.9	27 $\frac{3}{8}$	27 $\frac{3}{4}$	26 $\frac{3}{8}$	26 $\frac{3}{4}$	1,666	3,034
	72-76.9	28	27 $\frac{3}{8}$	28	27 $\frac{3}{4}$	700	1,198
148-153.9	77-81.9	27 $\frac{3}{8}$	27 $\frac{3}{8}$	29 $\frac{1}{2}$	29 $\frac{3}{8}$	152	229
	65-69.9	29 $\frac{3}{8}$	29 $\frac{1}{4}$	26 $\frac{3}{8}$	26 $\frac{3}{4}$	422	746
	70-74.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	27 $\frac{3}{8}$	27 $\frac{3}{8}$	1,506	2,589
154-159.9	75-79.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	29	28 $\frac{3}{8}$	765	1,135
	80-84.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	30 $\frac{3}{8}$	30 $\frac{1}{4}$	201	301
	69-73.9	30 $\frac{3}{8}$	30 $\frac{3}{4}$	28	28	565	917
160-165.9	74-78.9	30 $\frac{3}{8}$	30 $\frac{3}{4}$	29 $\frac{1}{2}$	29	1,214	1,771
	79-83.9	30 $\frac{3}{8}$	30 $\frac{3}{4}$	30 $\frac{1}{2}$	30 $\frac{1}{4}$	578	758
	84-88.9	30 $\frac{3}{8}$	30 $\frac{3}{4}$	32	31 $\frac{3}{8}$	184	207
166-171.9	73-77.9	32 $\frac{1}{4}$	32 $\frac{1}{4}$	29 $\frac{3}{8}$	29 $\frac{1}{4}$	545	771
	78-82.9	32 $\frac{1}{8}$	32 $\frac{1}{4}$	30 $\frac{3}{8}$	30 $\frac{1}{2}$	926	1,296
	83-87.9	32	32	32	31 $\frac{3}{8}$	530	492
172-177.9	88-92.9	32 $\frac{1}{8}$	32 $\frac{1}{8}$	33 $\frac{1}{2}$	33 $\frac{1}{4}$	165	124
	77-81.9	33 $\frac{3}{8}$	33 $\frac{1}{2}$	30 $\frac{3}{8}$	30 $\frac{3}{4}$	608	583
	82-86.9	33 $\frac{3}{8}$	33 $\frac{3}{8}$	32 $\frac{3}{8}$	32 $\frac{1}{2}$	1,240	784
178-183.9	87-91.9	33 $\frac{3}{8}$	33 $\frac{1}{2}$	34	33 $\frac{3}{8}$	715	348
	92-96.9	33	33 $\frac{1}{4}$	35 $\frac{1}{4}$	35	192	77
	81-85.9	34 $\frac{3}{8}$	34 $\frac{3}{8}$	32 $\frac{3}{8}$	32 $\frac{1}{2}$	859	470
166-171.9	86-90.9	34 $\frac{3}{8}$	34 $\frac{1}{2}$	34 $\frac{1}{8}$	34 $\frac{1}{2}$	1,752	600
	91-95.9	34 $\frac{1}{4}$	34 $\frac{1}{4}$	35 $\frac{1}{4}$	35 $\frac{3}{8}$	853	232
	96-100.9	34 $\frac{1}{4}$	34 $\frac{3}{8}$	37 $\frac{1}{8}$	36 $\frac{3}{4}$	229	44
172-177.9	84-88.9	35 $\frac{3}{8}$	35 $\frac{1}{4}$	33 $\frac{3}{4}$	33 $\frac{3}{8}$	912	267
	89-93.9	35 $\frac{1}{2}$	35 $\frac{3}{8}$	35 $\frac{1}{4}$	35 $\frac{3}{8}$	1,429	408
	94-98.9	35 $\frac{3}{8}$	35 $\frac{1}{2}$	36 $\frac{3}{8}$	37	616	127
178-183.9	99-103.9	35 $\frac{3}{8}$	35 $\frac{1}{2}$	38 $\frac{1}{8}$	38 $\frac{1}{2}$	151	24
	85-89.9	36 $\frac{3}{8}$	37	34 $\frac{1}{4}$	34 $\frac{1}{2}$	312	103
	90-94.9	36 $\frac{3}{8}$	37	35 $\frac{3}{8}$	36	737	165
166-171.9	95-99.9	36 $\frac{3}{8}$	36 $\frac{3}{8}$	37 $\frac{1}{4}$	37 $\frac{3}{8}$	376	82

<sup>1</sup> Group I—District of Columbia, Illinois, Maryland, Michigan, Ohio, Pennsylvania and Virginia.

<sup>2</sup> Group II—Alabama, California, Colorado, Iowa, Kansas, Minnesota, Nebraska, Tennessee, Texas, and Utah.

TABLE 30.—Mean chest girth and mean hip height for each height-hip girth interval for girls in 2 groups of States

Stature interval (centimeters)	Hip girth interval (centimeters)	Means in inches for—				Number of cases	
		Hip height		Chest girth		Group I <sup>1</sup>	Group II <sup>2</sup>
		Group I <sup>1</sup>	Group II <sup>2</sup>	Group I <sup>1</sup>	Group II <sup>2</sup>		
100-105.9	50-53.9	19	19 $\frac{1}{4}$	21	20 $\frac{7}{8}$	54	181
	54-57.9	19 $\frac{1}{4}$	19 $\frac{3}{8}$	21 $\frac{3}{4}$	21 $\frac{5}{8}$	147	372
	58-61.9	19 $\frac{3}{8}$	19 $\frac{1}{2}$	22 $\frac{1}{2}$	22 $\frac{3}{8}$	51	104
106-111.9	52-55.9	20 $\frac{3}{8}$	20 $\frac{5}{8}$	21 $\frac{1}{2}$	21 $\frac{5}{8}$	152	371
	56-59.9	20 $\frac{3}{8}$	20 $\frac{3}{4}$	22 $\frac{1}{2}$	22 $\frac{1}{2}$	350	929
	60-63.9	20 $\frac{7}{8}$	20 $\frac{7}{8}$	23	22 $\frac{3}{8}$	113	287
112-117.9	54-57.9	22 $\frac{1}{4}$	22	22 $\frac{1}{4}$	22 $\frac{1}{4}$	200	589
	58-61.9	22 $\frac{1}{4}$	22 $\frac{1}{8}$	22 $\frac{3}{8}$	22 $\frac{1}{2}$	619	1,613
	62-65.9	22 $\frac{3}{8}$	22 $\frac{1}{4}$	23 $\frac{3}{8}$	23 $\frac{3}{8}$	227	625
118-123.9	66-69.9	22 $\frac{1}{2}$	22 $\frac{1}{4}$	24 $\frac{3}{4}$	25	40	100
	56-59.9	23 $\frac{1}{2}$	23 $\frac{3}{8}$	22 $\frac{7}{8}$	22 $\frac{3}{8}$	255	693
	60-63.9	23 $\frac{3}{8}$	23 $\frac{1}{2}$	23 $\frac{1}{2}$	23 $\frac{1}{2}$	762	2,080
124-129.9	64-67.9	23 $\frac{3}{8}$	23 $\frac{3}{8}$	24 $\frac{3}{8}$	24 $\frac{3}{8}$	430	1,040
	68-71.9	23 $\frac{3}{4}$	23 $\frac{3}{4}$	25 $\frac{1}{4}$	25 $\frac{1}{4}$	129	203
	59-62.9	25 $\frac{1}{8}$	25	23 $\frac{3}{4}$	23 $\frac{3}{8}$	348	919
130-135.9	63-66.9	25 $\frac{1}{8}$	25	24 $\frac{1}{2}$	24 $\frac{3}{8}$	888	2,230
	67-70.9	25 $\frac{1}{8}$	25 $\frac{1}{2}$	25 $\frac{1}{4}$	25 $\frac{1}{8}$	490	1,113
	71-74.9	25 $\frac{1}{8}$	25 $\frac{1}{8}$	26 $\frac{3}{8}$	26 $\frac{1}{4}$	151	272
136-141.9	61-65.9	26 $\frac{1}{2}$	26 $\frac{3}{8}$	24 $\frac{3}{8}$	24 $\frac{1}{2}$	411	1,065
	66-70.9	26 $\frac{3}{8}$	26 $\frac{1}{2}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$	1,033	2,499
	71-75.9	26 $\frac{5}{8}$	26 $\frac{3}{8}$	26 $\frac{3}{8}$	26 $\frac{3}{8}$	458	964
142-147.9	76-80.9	26 $\frac{3}{4}$	26 $\frac{3}{4}$	28 $\frac{1}{4}$	28	125	233
	65-69.9	28	27 $\frac{3}{8}$	25 $\frac{3}{8}$	25 $\frac{1}{4}$	522	1,420
	70-74.9	28	28	27	26 $\frac{3}{8}$	828	2,050
148-153.9	75-79.9	28 $\frac{1}{8}$	28 $\frac{3}{8}$	28	27 $\frac{3}{4}$	395	806
	80-84.9	28 $\frac{1}{8}$	28 $\frac{3}{8}$	29 $\frac{3}{8}$	29 $\frac{3}{8}$	125	244
	64-68.9	29 $\frac{1}{4}$	29 $\frac{1}{4}$	25 $\frac{3}{8}$	25 $\frac{3}{8}$	52	212
154-159.9	69-73.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	26 $\frac{3}{8}$	26 $\frac{3}{8}$	478	1,311
	74-78.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	27 $\frac{3}{8}$	27 $\frac{3}{8}$	620	1,542
	79-83.9	29 $\frac{1}{4}$	29 $\frac{3}{8}$	29 $\frac{3}{8}$	29 $\frac{3}{8}$	382	729
160-165.9	84-88.9	29 $\frac{3}{8}$	29 $\frac{3}{8}$	30 $\frac{3}{8}$	30 $\frac{3}{8}$	164	246
	89-93.9	29 $\frac{1}{4}$	29 $\frac{3}{8}$	32 $\frac{3}{4}$	32 $\frac{3}{4}$	78	72
	69-73.9	30 $\frac{3}{8}$	30 $\frac{3}{8}$	27 $\frac{1}{4}$	27	129	343
166-171.9	74-78.9	30 $\frac{3}{8}$	30 $\frac{3}{8}$	28 $\frac{1}{4}$	28	511	1,239
	79-83.9	30 $\frac{3}{8}$	30 $\frac{3}{8}$	29 $\frac{3}{8}$	29 $\frac{1}{4}$	731	1,282
	84-88.9	30 $\frac{3}{8}$	30 $\frac{3}{8}$	30 $\frac{3}{8}$	30 $\frac{3}{4}$	704	733
172-177.9	89-93.9	30 $\frac{1}{4}$	30 $\frac{3}{8}$	32 $\frac{1}{4}$	32 $\frac{1}{4}$	466	317
	78-82.9	33	33	29 $\frac{3}{4}$	29 $\frac{3}{8}$	128	252
	83-87.9	33	32 $\frac{3}{8}$	30 $\frac{7}{8}$	30 $\frac{3}{8}$	618	809
178-183.9	88-92.9	32 $\frac{3}{4}$	32 $\frac{3}{4}$	32	31 $\frac{7}{8}$	1,441	1,092
	93-97.9	32 $\frac{3}{4}$	32 $\frac{3}{8}$	33 $\frac{1}{4}$	32 $\frac{3}{8}$	958	630
	98-102.9	32 $\frac{1}{2}$	32 $\frac{3}{8}$	34 $\frac{1}{2}$	34 $\frac{3}{8}$	332	228
166-171.9	86-90.9	34 $\frac{1}{8}$	34 $\frac{1}{8}$	31 $\frac{3}{8}$	31 $\frac{1}{2}$	329	287
	91-95.9	34	34	32 $\frac{3}{8}$	32 $\frac{3}{4}$	563	398
	96-100.9	34	33 $\frac{7}{8}$	34	33 $\frac{7}{8}$	336	227

<sup>1</sup> Group I—District of Columbia, Illinois, Maryland, Michigan, Ohio, Pennsylvania and Virginia.

<sup>2</sup> Group II—Alabama, California, Colorado, Iowa, Kansas, Minnesota, Nebraska, Tennessee, Texas, and Utah.

At the further suggestion of the committee, the age distributions of the children in each of the size rectangles were obtained. The percentage of children of a given age based on the total number of children found in a given rectangle was computed for each size (rectangle). These percentages are given in tables 31 and 32.<sup>26</sup>

<sup>26</sup> Some schedules of 18-year-old children were by accident included in the calculations of the final sizing scheme and were only discovered after the close of the project.

TABLE 31.—Percentage distribution, by age, of boys within each stature-hip girth interval

Size	Percentage distribution for age—														
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years	18 years <sup>1</sup>
B <sub>1</sub>	47.7	46.0	6.3												
C <sub>1</sub>	54.2	38.8	6.9		0.1										
D <sub>1</sub>	62.7	32.8	3.7	0.8											
B <sub>2</sub>	12.6	46.3	35.2	4.2	1.7										
C <sub>2</sub>	16.7	49.9	27.7	4.9	.8										
D <sub>2</sub>	19.2	48.7	24.5	5.9	1.1	0.3	0.3								
B <sub>3</sub>	2.1	19.7	50.0	22.3	5.1	.4	.4								
C <sub>3</sub>	2.3	24.4	46.6	20.6	4.9	1.0	.2								
D <sub>3</sub>	2.5	27.1	47.8	17.3	4.5	.8									
B <sub>4</sub>	.5	6.0	34.7	36.2	18.6	3.1	.8	0.1							
C <sub>4</sub>	.2	5.3	29.2	39.6	19.3	5.1	1.0	.2	0.1						
D <sub>4</sub>	.2	6.1	30.7	36.2	20.0	5.4	1.2	.2							
E <sub>4</sub>		10.8	28.0	32.5	22.3	4.5	.6	1.3							
B <sub>5</sub>		.7	10.1	31.7	35.7	15.2	5.2	1.2	.2						
C <sub>5</sub>	.1	.6	8.1	27.7	34.0	20.3	7.0	1.7	.4	0.1					
D <sub>5</sub>	.1	.6	8.0	24.0	33.2	22.5	8.1	2.8	.6	.1					
E <sub>5</sub>		1.6	9.9	30.3	31.5	19.5	4.4	1.6	1.2						
B <sub>6</sub>		.3	1.7	12.6	29.5	27.3	19.9	6.9	1.5	.3					
C <sub>6</sub>		.1	.9	7.3	24.5	32.7	21.9	9.2	2.6	.7	0.1				
D <sub>6</sub>		.1	.7	7.3	22.4	29.0	23.6	11.1	3.9	1.6	.3				
E <sub>6</sub>			2.1	8.1	28.2	30.3	18.3	8.5	2.1	1.8	.3		0.3		
B <sub>7</sub>				1.9	11.5	27.1	31.7	19.6	6.2	1.7	.3				
C <sub>7</sub>		.1	.1	1.0	8.0	21.1	29.8	23.3	12.4	3.3	.7	0.1	.1		
D <sub>7</sub>			.1	.7	6.1	19.0	30.2	24.1	13.2	5.3	1.1	.2			
E <sub>7</sub>			.3	1.8	7.9	22.6	32.3	19.9	11.5	2.9	.8				
B <sub>8</sub>				.2	2.0	8.6	23.0	30.7	23.2	10.3	1.7	.3			
C <sub>8</sub>					1.3	7.6	19.4	28.7	26.0	12.5	3.9	.5	.1		
D <sub>8</sub>					.9	6.9	16.9	27.6	26.5	15.2	4.9	.9	.2		
E <sub>8</sub>			.2		2.0	7.4	24.1	28.1	20.7	13.5	3.6	.2	.2		
B <sub>9</sub>					.4	2.2	8.9	21.3	32.1	23.4	9.5	2.0	.2		
C <sub>9</sub>				.1	8.0	21.1	29.8	23.3	29.7	28.1	13.6	3.2	.4	0.1	
D <sub>9</sub>					.1	1.2	5.8	15.2	29.3	29.3	14.6	4.0	.3	.1	0.1
E <sub>9</sub>					.3	1.2	9.7	21.0	31.2	20.7	12.0	2.6	1.0	.3	
B <sub>10</sub>						.2	2.0	7.4	25.6	34.0	23.1	5.8	1.7	.2	
C <sub>10</sub>						.1	1.1	6.2	19.3	31.5	26.6	11.3	3.3	.6	
D <sub>10</sub>						.1	1.5	5.6	18.8	29.2	24.8	13.0	5.5	1.3	.2
E <sub>10</sub>							2.4	6.9	21.1	33.2	20.8	9.4	4.5	.7	1.0
B <sub>11</sub>						.1	.2	1.6	9.6	28.3	33.3	20.1	5.6	1.0	.2
C <sub>11</sub>							.1	1.6	5.7	21.3	32.3	23.2	10.2	4.8	.8
D <sub>11</sub>							.1	.6	5.2	17.1	28.0	22.4	16.8	7.8	2.0
E <sub>11</sub>							.4	2.2	8.9	17.1	22.7	18.6	14.5	11.9	3.7
B <sub>12</sub>								.2	2.1	12.9	27.6	30.3	18.0	7.8	1.1
C <sub>12</sub>									1.5	7.7	20.4	29.1	24.4	13.1	3.8
D <sub>12</sub>									1.1	5.5	17.1	23.6	27.3	20.9	4.5
E <sub>12</sub>									.7	5.5	22.0	23.8	23.8	18.7	5.5
B <sub>13</sub>								.1	.2	.5	4.2	15.0	27.7	29.8	19.4
C <sub>13</sub>										.3	2.2	12.4	27.4	28.7	24.3
D <sub>13</sub>										.4	2.2	10.5	21.8	31.4	27.6
E <sub>13</sub>										.6	2.9	9.7	22.9	29.7	27.4
B <sub>14</sub>										.2	1.7	8.2	24.6	34.2	28.5
C <sub>14</sub>											.7	6.7	20.3	34.6	30.9
D <sub>14</sub>										.2	.7	7.0	17.7	31.9	35.4

<sup>1</sup> See footnote 26, p. 52.

TABLE 32.—Percentage distribution, by age, of girls within each stature-hip girth interval

Size	Percentage distribution for age—														
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years	18 years <sup>1</sup>
B <sub>1</sub>	45.5	46.4	7.2	0.9											
C <sub>1</sub>	49.1	41.6	7.7	1.4		0.2									
D <sub>1</sub>	54.8	38.7	6.5												
B <sub>2</sub>	13.2	45.1	36.1	5.2	0.4										
C <sub>2</sub>	12.7	49.2	30.2	6.6	1.1	.1	0.1								
D <sub>2</sub>	16.3	51.0	26.0	6.5	.2										
B <sub>3</sub>	1.8	21.9	47.6	22.7	5.2	.6	.1	0.1							
C <sub>3</sub>	1.7	21.4	45.8	24.2	6.0	.6	.2	.1							
D <sub>3</sub>	2.0	22.5	46.0	23.5	4.9	1.0	.1								
E <sub>3</sub>	2.9	30.0	39.3	22.1	3.6	2.1									
B <sub>4</sub>		5.3	29.4	40.5	18.5	5.1	.9	.3							
C <sub>4</sub>	.3	4.1	26.0	38.6	21.8	7.9	1.1	.2							
D <sub>4</sub>	.3	4.8	27.9	36.7	22.4	6.4	1.3	.1		0.1					
E <sub>4</sub>		4.8	31.6	36.2	19.0	7.5	.6			.3					
B <sub>5</sub>		.6	7.1	29.4	34.3	21.3	6.4	.9							
C <sub>5</sub>		.5	6.7	24.1	35.5	23.3	7.9	1.7	.2	0.1					
D <sub>5</sub>	.1	.7	6.6	25.1	33.2	23.5	8.0	2.1	.6	.1					
E <sub>5</sub>		1.2	8.5	28.1	31.7	20.3	7.1	2.6	.5						
B <sub>6</sub>			1.0	7.1	28.0	34.9	20.1	7.6	1.2	.1					
C <sub>6</sub>		.1	.7	5.9	22.0	34.9	24.6	9.2	2.2	.3		0.1			
D <sub>6</sub>		.1	1.1	7.7	21.7	32.6	24.0	9.1	3.4	.3					
E <sub>6</sub>			.6	10.3	23.5	33.5	20.9	9.8	1.4						
B <sub>7</sub>			.1	.9	7.7	24.8	37.1	21.5	7.0	.8	0.1				
C <sub>7</sub>			.1	.6	7.3	20.1	35.0	24.7	9.3	2.6	.3				
D <sub>7</sub>				1.0	7.6	21.5	33.0	22.3	10.8	3.0	.7		.1		
E <sub>7</sub>				1.9	7.0	23.3	35.5	20.1	7.9	3.5	.8				
A <sub>8</sub>				.8	.8	11.7	37.8	30.7	13.6	3.4	.8			0.4	
B <sub>8</sub>			.1	.2	1.7	8.3	25.7	37.0	19.8	6.2	.8			.1	0.1
C <sub>8</sub>			.1	.2	1.0	6.2	21.4	33.9	25.6	9.0	2.4	.2			
D <sub>8</sub>				.1	1.6	7.7	19.1	31.2	23.5	10.5	4.0	1.2	.5	.5	0.1
E <sub>8</sub>					.5	8.1	17.3	22.0	22.4	13.2	8.5	2.9	2.2	2.7	.2
A <sub>9</sub>				.4	1.7	11.0	36.5	33.7	14.6	1.7	.2	.2			
B <sub>9</sub>				.2	1.0	8.5	28.7	35.1	19.9	5.5	.8	.2		.1	
C <sub>9</sub>				.1	1.2	7.0	21.6	30.4	22.6	11.0	3.6	1.5	.9	.9	.1
D <sub>9</sub>				.1	.8	4.4	13.1	20.0	20.5	19.0	10.6	6.7	4.0	4.0	.8
E <sub>9</sub>					.5	2.9	8.0	16.4	17.2	16.4	14.2	14.8	8.3	8.3	1.3
A <sub>10</sub>				.2	.4	2.5	20.5	33.3	25.8	12.7	3.5	.7	.4	.4	
B <sub>10</sub>				.1	.2	1.9	9.4	26.7	33.2	17.3	6.7	2.7	1.7	1.7	.1
C <sub>10</sub>					.1	.7	4.9	15.7	23.6	21.6	15.6	10.7	6.3	6.3	.8
D <sub>10</sub>						.6	3.1	8.1	15.3	18.6	22.4	18.8	11.4	11.4	1.7
E <sub>10</sub>						.3	1.5	6.2	15.6	18.1	21.3	20.5	14.4	14.4	2.1
A <sub>11</sub>							.8	6.6	21.6	28.7	22.4	11.8	5.0	2.6	.5
B <sub>11</sub>							.1	.2	2.9	12.3	24.1	25.2	18.1	10.3	5.7
C <sub>11</sub>							.1	.8	5.8	13.8	21.2	23.0	21.2	12.0	2.0
D <sub>11</sub>								.1	.5	3.9	10.7	16.7	25.5	15.7	1.3
E <sub>11</sub>							.2	.2	5.0	10.5	15.4	24.8	24.6	17.5	1.8
B <sub>12</sub>									1.0	6.2	13.1	19.6	24.7	20.5	13.8
C <sub>12</sub>									.1	1.6	6.7	17.7	27.6	26.2	18.8
D <sub>12</sub>									.2	2.1	5.1	14.6	26.1	30.0	19.2

<sup>1</sup> See footnote 26, p. 52.

### Application of the Proposed System to Garment and Pattern Sizing

Since the measurements made in this study were taken next to the skin, the figures given in the proposed standard as set up in tables 23 and 25 refer to body measurements and not garment sizes. As they stand, they can be used for the manufacture of a standard set of forms or mannequins. They also supply the essential basic body dimensions for the development of standard sizes for all garments except shoes, hats, and gloves.

The formulation of garment standards would require agreements in the trade on the tolerances that should be added to these measurements. In working out tolerances, such factors as comfort and style features would have to be taken into account. In the case of outer wear, allowance would also have to be made for the garments worn underneath.

Each proposed standard measurement was obtained by averaging the corresponding measurement of all the children who came within a given group by virtue of their height and hip measure. In other words, the children were divided into groups on the basis of their height and hip measure rather than on the basis of their age. Average measurements then were calculated for each of the groups so formulated.

Since the control groupings are those of height and hip, the sizes should be designated on this basis. In addition, garments so sized could be labeled with their chest circumference, leg length, or any other measurement desired. In fact, the differences in sizes might be graded in terms of differences in any measurement that the industry may deem especially significant in the sizing of a particular article.

Thus, if an industry so chooses, a standard system for a particular item may be set up by adjusting the necessary tolerances for the garment, so that chest measures from size to size or crotch measures from size



to size are rounded off into uniform intervals. However, no matter on which measurement a garment is graded, the size that a child takes should depend on his height and hip measure.

The proposed system sets up 12 groupings, corresponding to regular sizes, for girls 4 to 17 years of age; 13 groupings are set up for boys of those ages (tables 23 and 25). These groupings were made by taking those portions of the height-hip distributions in which the mass of children were concentrated (figs. 6 and 7) and dividing them by 12 for the girls and by 13 for the boys. In other words, having decided into how many regular groups the children are to be classified, the sizes of the height-hip intervals (that is, the height and the hip measure limits of the groups) are fixed.

Of the children measured, the number which comes in each group is also fixed. If fewer sizes are set up, the intervals between each will be larger, and the number of children in each group will be larger. Averages of the dimensions of all the children in a group therefore will be less representative of the children in that group, and the fit of the garments so sized will be poorer. If more sizes are set up, the intervals will be smaller, the number of children in each group smaller, the average dimensions for those in the group will be more representative of all the children in that group, and the garments so sized will fit all the children in that group better.

The number of groups selected also automatically sets the differences between the values of each dimension in the different size groups. If the size of these height-hip groupings were to be changed to include a greater or a smaller number of children, the differences between the values of the dimensions from group to group automatically would become greater or smaller.

Using the same scheme of height-hip intervals, a series of auxiliary sizes for both boys and girls was calculated (tables 24 and 26) for those in the trade interested in the "above-regular" and "below-regular" children. The basic idea was to meet the needs of all interests and to allow manufacturers a choice of sizes. Perhaps no one manufacturer or distributor would carry sizes corresponding to all of these groupings.

For example, some may prefer to manufacture or stock every other one of the regulars. Some catering to specialty business may be interested in a few of the below-regular and of the above-regular groups. Choice can be made to suit the demands of that portion of the trade concerned.

### Application of the Proposed System to Retailing

If the proposed standard were adopted, a mother ordering or shopping for a child's clothing would give, not his age, but his height and hip measure. This would identify him with the group of children, the averages of whose dimensions had been used as the basic nude form for a given size.

Suppose this size had been designated by agreement in the trade as XYZ. Then, if the mother ordered a coat, the store would deliver a coat of the size XYZ. Dimensions of the coat would be the average basic body measurements of that group, plus all the tolerances the coat manufacturers and distributors had agreed upon for that size.

If the mother ordered a suit of underwear for the same boy, that would also be size XYZ. But the dimensions of the suit of underwear would be the basic body dimensions of the same size group, plus all the tolerances the underwear manufacturers and distributors had agreed upon for that size. Tolerances, of course, would be different in the two cases because of the nature of the garments.

Agreement on symbols to designate the sizes is another step in the formulation of such a standard. The suggestion has been made that each size be designated by the average nude body height and hip measure (in inches) for that height-hip group. For example, 50-25 and 57-30 would be typical designations. Letters and consecutive numerals have also been suggested. However, the naming of the sizes will not be discussed here since that is a matter that can be decided more appropriately by the manufacturers, distributors, and users of the garments.

# Supplementary Studies Based on Body Measurements of Children

## Bivariate Distributions

A great deal of scientific interest has been expressed in the relationships that exist between the different body measurements of children at various stages in their development. Some of these relationships are shown in the many bivariate distributions that were obtained during the analysis of the measurements. A few of these are included here.

Figures 14 to 17<sup>26a</sup> show such distributions based on a sample of 69,661 boys 4 to 17 years of age. These illustrate, respectively: The development of chest girth of boys with age; the relationship between stature and chest girth; the relationship between stature and arm length; and the relationship between hip girth and chest girth. Figures 18 to 21<sup>26a</sup> show similar distributions based on a sample of 64,146 girls of the same age range, with the exception that age and hip girth have been given instead of stature and chest girth.

## Analysis of Measurements on Age Basis

Although the data obtained through this study indicate that age is a poor basis for sizing garments (pp. 29 to 39), the widespread interest in the dimensions of hypothetical average children of each age made it seem important to include in this report an analysis of the distribution of measurements on an age basis. An age group was defined as a 12-month interval beginning with the last birthday of a child and ending with his next birthday. Thus, all children at least 60 months old and less than 72 months were considered to be 5 years of age.

## Frequency Distributions

Because of the size of the sample on which this study is based it was possible, by plotting percentage frequencies, to obtain a fairly good notion of the type of distribution that may be expected for any given measurement for a given age. These frequency diagrams for most measurements were found to give fairly smooth curves. Figures 22 to 28 are presented as samples of

distributions of 7 measurements for boys and girls for each of the ages 5 to 14, inclusive.<sup>27</sup> These show that: (1) The distribution for stature (fig. 23) and length of arm (fig. 28) are fairly symmetrical, while the distributions of chest girth (fig. 26), hip girth (fig. 27), and weight (fig. 22) are skewed; (2) the variation of all measurements increases with age for both boys and girls; (3) the distribution of lengths for the younger boys is not much different from the girls for corresponding ages.

## Test for Normality

The skewness of some of the girths and the symmetry of some of the lengths are apparent from the figures. A statistical test was made on four important measurements in order to determine whether these depart significantly from the normal distribution.

The analysis consisted of calculating the quantities  $g_1$  and  $g_2$  and the corresponding standard error (*S. E.*) for hip height, weight, stature, and chest girth for each sex, for ages 4 to 14, inclusive. For a normal distribution both  $g_1$  and  $g_2$  are zero. A positive value for  $g_1$  indicates a positive skewness, and a negative value for  $g_1$  indicates a negative skewness. A positive value for  $g_2$  indicates a peaked curve, and a negative value a flat topped curve.

Table 33 gives the results of this study. From an examination of the values of  $g_1$  and  $g_2$  it will be seen that the distribution curves for weight and chest girth tend to be peaked and skewed to the right. These results may be termed significant, since both  $g_1$  and  $g_2$  are larger than twice their standard errors. The values of  $g_1$  and  $g_2$  for stature and hip height, however, are on the whole smaller than the corresponding values of weight and chest girth.

Thus, though the distribution curves for two linear measurements depart from the normal for many age groups, they seem to be more symmetrical and less peaked than the distribution curves for chest girth and weight. The conclusion therefore may be drawn that when a population is defined as a 12-month interval, the measurements considered, with few exceptions, depart somewhat from the normal distribution.

<sup>26a</sup> In pocket on back of cover.

<sup>27</sup> These frequency distributions are based on the number of cases given in tables 34 and 35.

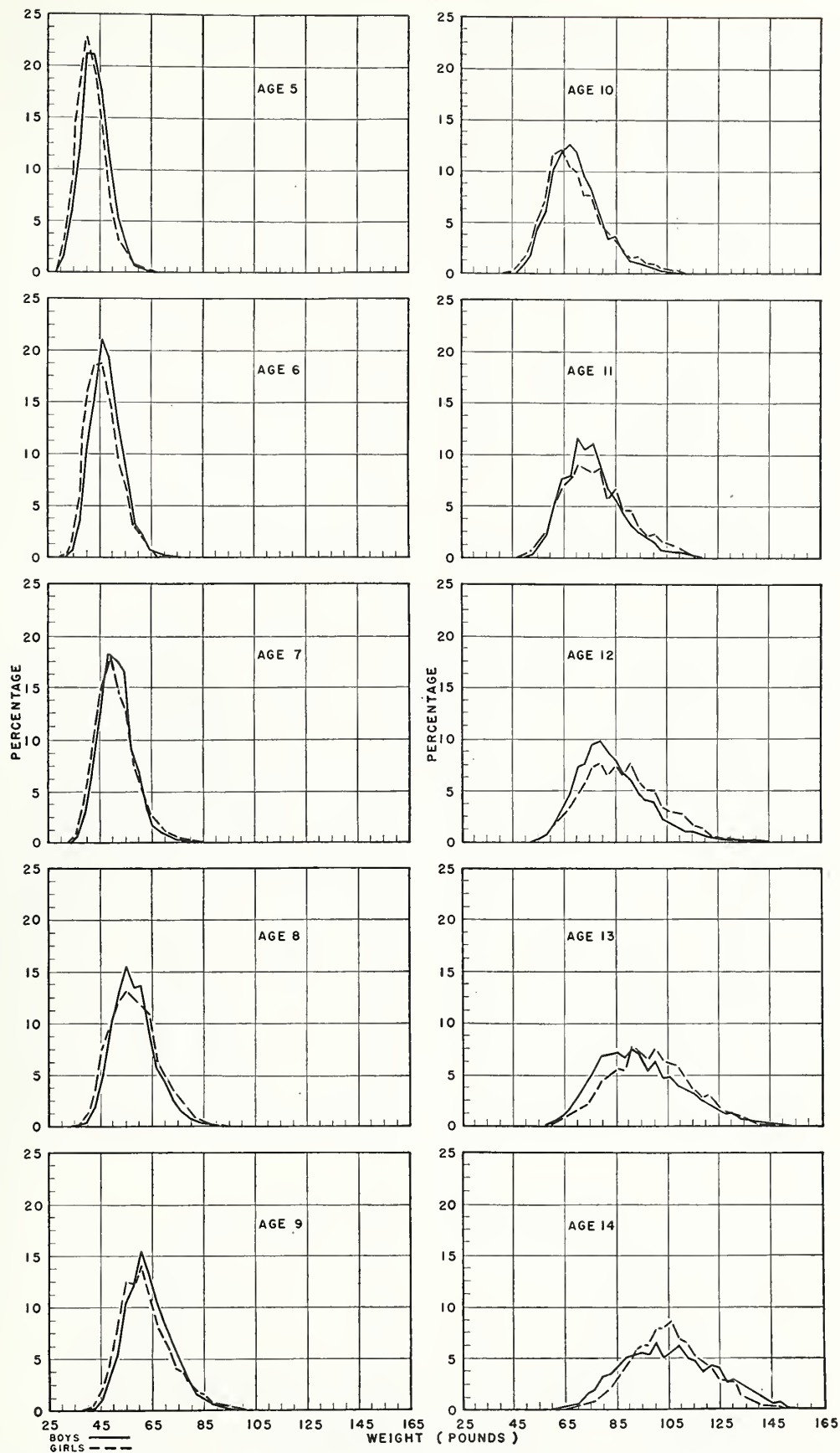


FIGURE 22.—Percentage frequency distribution according to weight of boys and girls from 5 to 14 years of age.

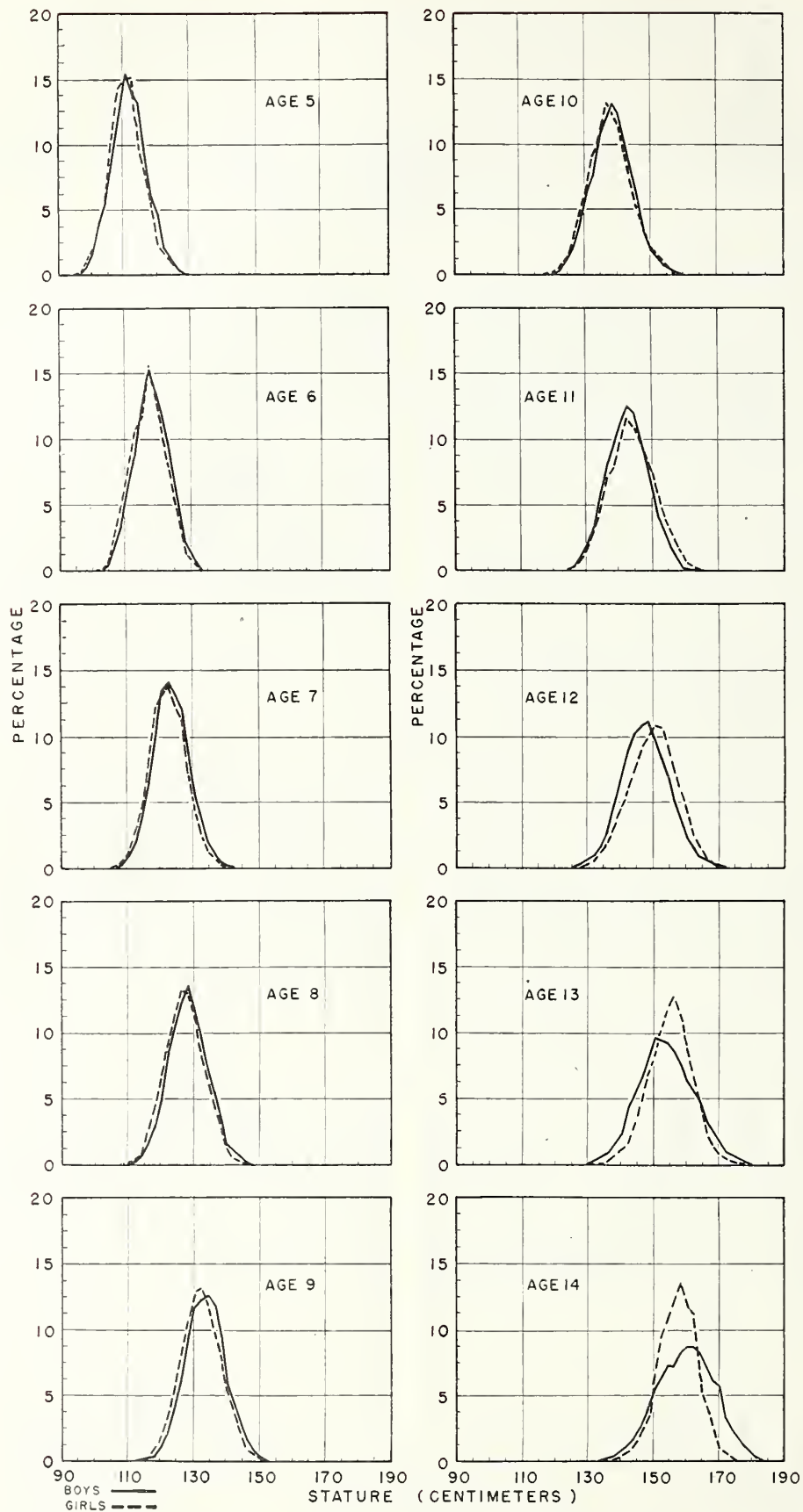


FIGURE 23.—Percentage frequency distribution according to stature of boys and girls from 5 to 14 years of age.

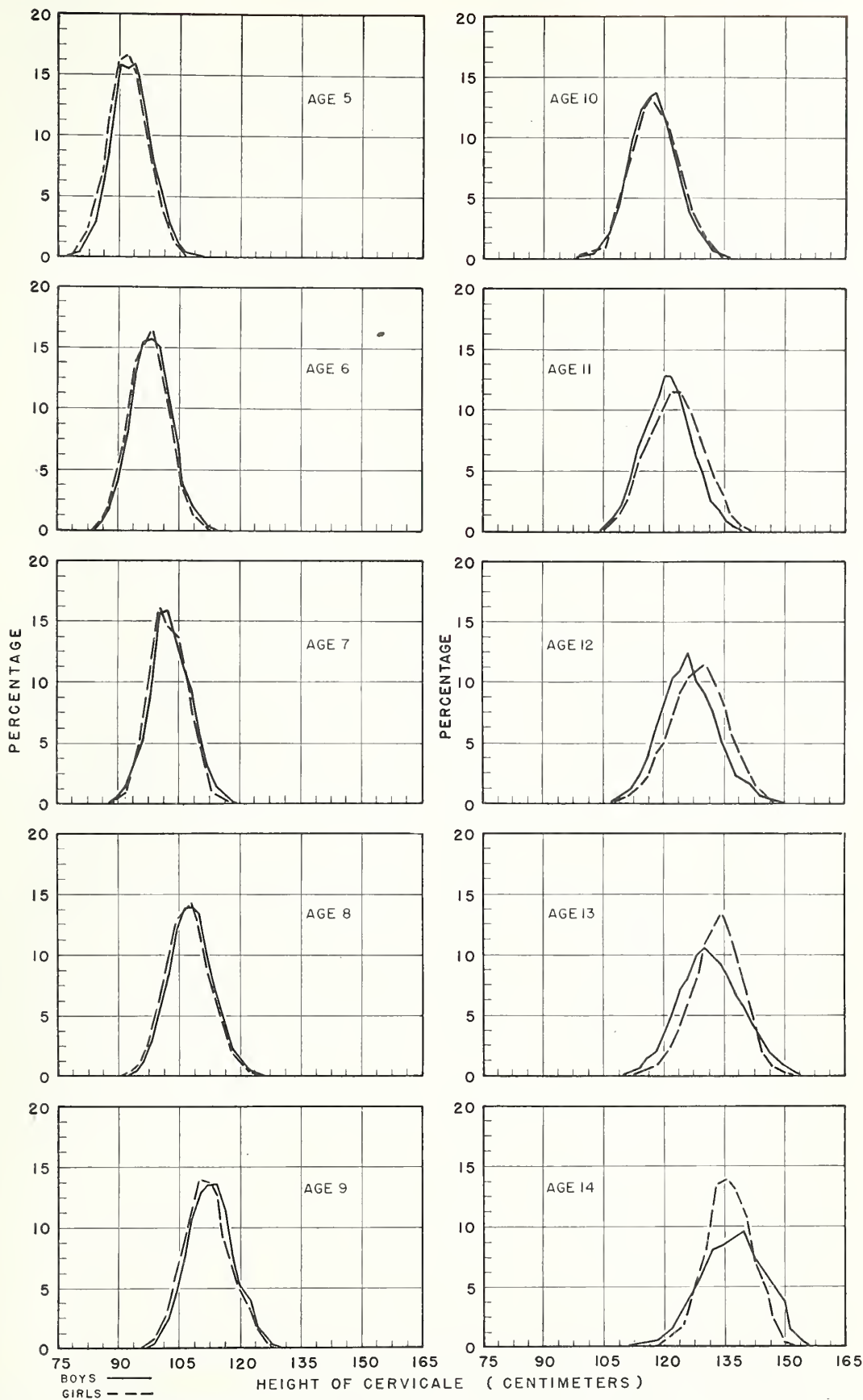


FIGURE 24.—Percentage frequency distribution according to height of cervicale of boys and girls from 5 to 14 years of age.

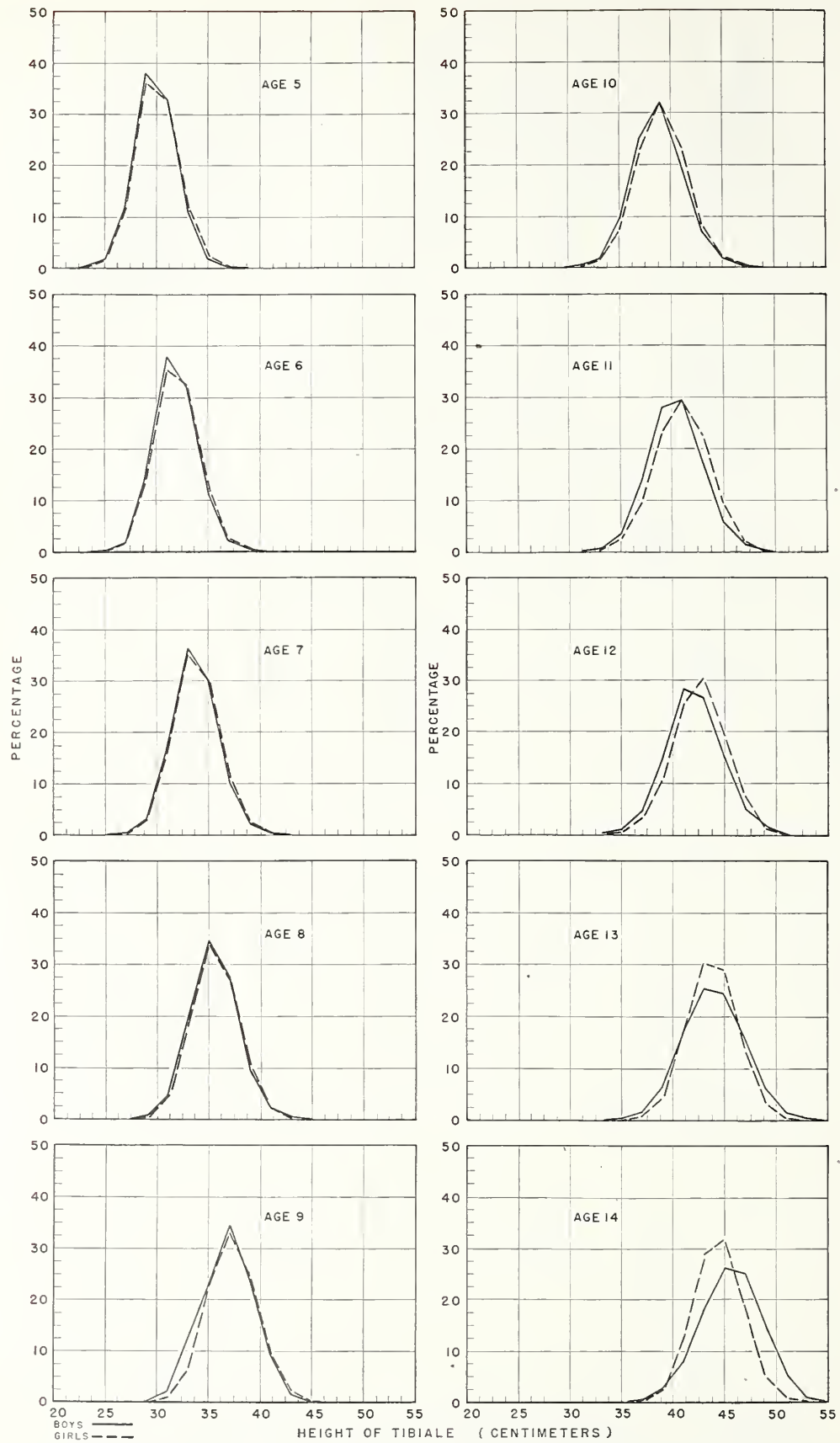


FIGURE 25.—Percentage frequency distribution according to height of tibiale of boys and girls from 5 to 14 years of age.

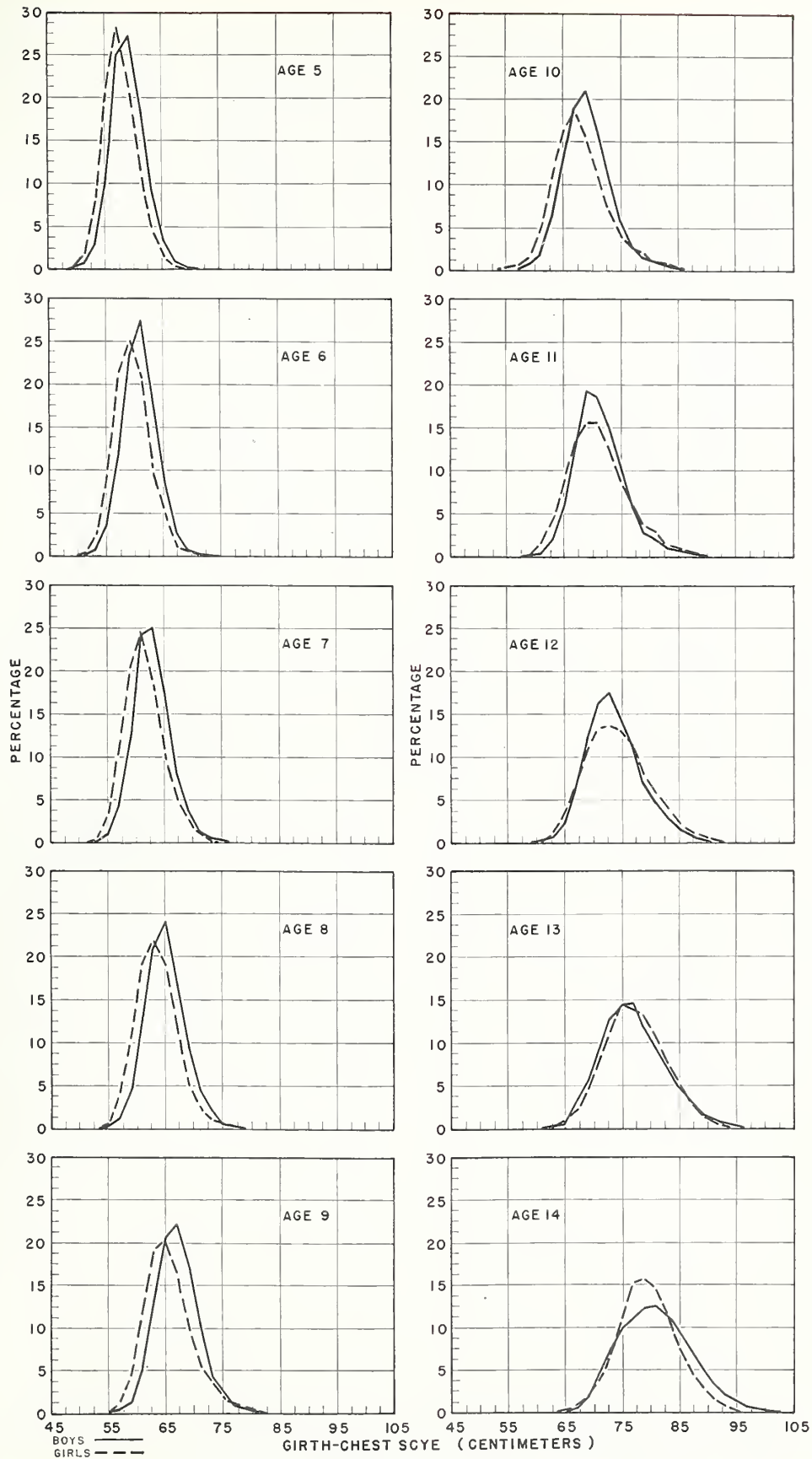


FIGURE 26.—Percentage frequency distribution according to girth of chest of boys and girls from 5 to 14 years of age.

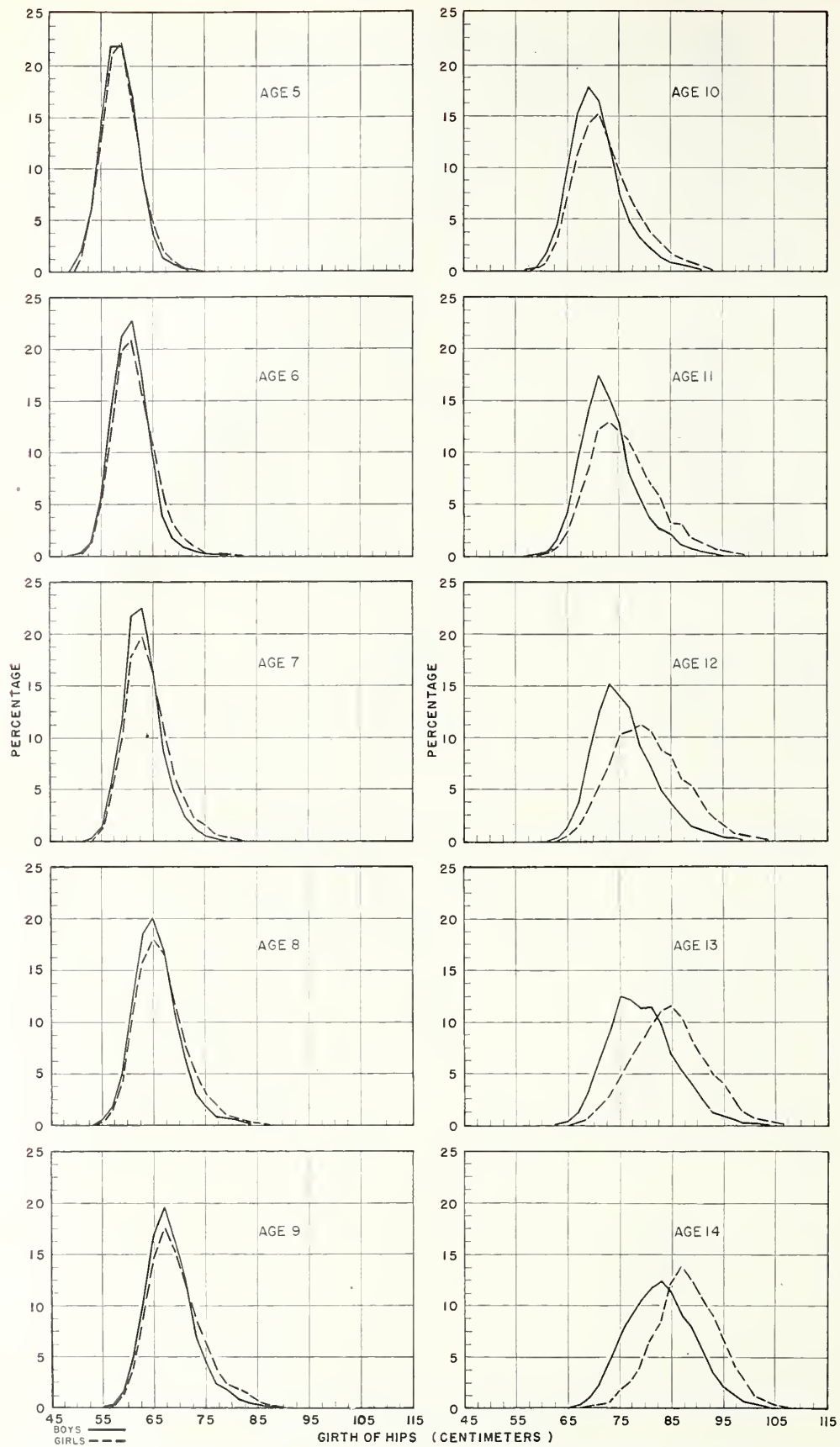


FIGURE 27.—Percentage frequency distribution according to girth of hip of boys and girls from 5 to 14 years of age.



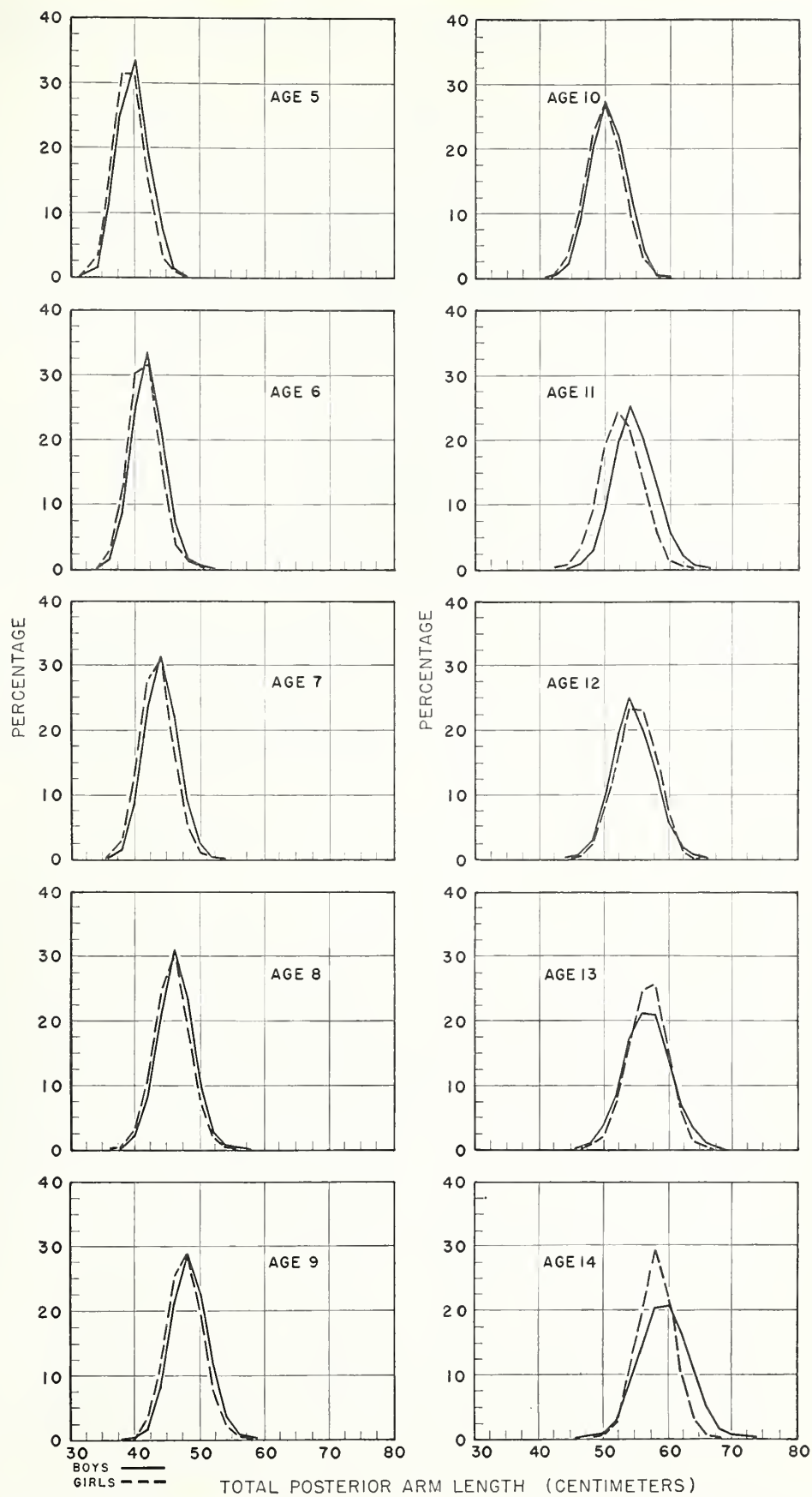


FIGURE 28.—Percentage frequency distribution according to length of arm posterior total of boys and girls from 5 to 14 years of age.

TABLE 33.—Test for departure from normality of the distributions of 4 measurements; all States combined, by ages, for boys and girls

Age	Hip height				Weight				Stature				Chest girth			
	g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>	
	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	
4	0.208	0.084	0.853	0.169	0.788	0.084	2.655	0.169	0.185	0.084	0.797	0.169	0.147	0.084	1.870	0.169
5	.273	.053	.648	.105	.746	.053	2.079	.105	.148	.053	.370	.105	.355	.053	.846	.105
6	.195	.038	.300	.076	.857	.038	2.187	.076	.180	.038	.320	.076	.486	.038	1.876	.076
7	.106	.034	.313	.069	.863	.034	2.006	.069	.057	.034	.158	.069	.588	.034	1.544	.069
8	.134	.032	.262	.064	.931	.032	2.353	.064	.083	.032	.249	.064	.693	.032	1.930	.064
9	.085	.031	.163	.062	1.061	.031	2.391	.062	.082	.031	.184	.062	.816	.031	.356	.062
10	.053	.030	.654	.060	1.080	.030	2.350	.060	.031	.030	.101	.060	.772	.030	1.827	.060
11	.107	.030	.256	.061	1.095	.030	2.178	.061	.170	.030	.418	.061	.813	.030	1.579	.061
12	.139	.030	.157	.060	1.042	.030	1.676	.060	.213	.030	.260	.060	.815	.030	1.360	.060
13	.003	.031	-.021	.062	.185	.031	.765	.062	.126	.031	-.134	.062	.519	.031	.446	.062
14	-.084	.035	-.023	.071	.509	.035	.212	.071	-.076	.035	-.256	.071	.336	.035	-.096	.071

Age	Hip height				Weight				Stature				Chest girth			
	g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>		g <sub>1</sub>		g <sub>2</sub>	
	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	S. E.	
4	0.380	0.077	0.399	0.154	0.672	0.078	1.181	0.154	0.320	0.078	0.299	0.154	0.539	0.078	1.512	0.154
5	.235	.048	.638	.096	.920	.048	1.972	.096	.272	.048	.472	.096	.705	.048	1.784	.096
6	.253	.036	.729	.073	1.008	.036	2.419	.073	.215	.036	.576	.073	.739	.036	1.867	.073
7	.233	.033	.454	.067	1.061	.033	2.248	.067	.151	.033	.371	.067	.826	.033	1.939	.067
8	.147	.032	.241	.065	1.138	.032	2.545	.065	.175	.032	.335	.065	.899	.032	2.090	.065
9	.141	.031	.312	.062	1.197	.031	2.435	.062	.195	.031	.401	.062	1.017	.031	2.063	.062
10	.123	.031	.179	.062	1.076	.031	1.772	.062	.178	.031	.305	.062	.921	.031	1.543	.062
11	-.076	.031	.141	.063	.896	.031	1.330	.063	.013	.031	.101	.063	.678	.031	.675	.063
12	-.154	.032	.105	.064	.772	.032	1.110	.064	-.163	.032	-.029	.064	.525	.032	.504	.064
13	-.072	.034	.168	.068	1.594	.034	.644	.068	-.268	.034	.339	.068	.336	.034	.402	.068
14	-.032	.041	.169	.081	.516	.041	.877	.081	.166	.041	.240	.081	.363	.041	.663	.081

Means and Standard Deviations

Means and standard deviations for each of the 35 measurements for boys and 36 for girls were calculated for each of the age groups 4 to 17. These quantities, along with the number of cases, are given in tables 34 and 35. It will be noticed that the number of cases within an age group is not constant from measurement

to measurement. This is due to the elimination of gross errors found in editing the schedules (p. 21). Although the maximum chest girth measurement was taken on the older boys the means of this measurement for each age were found to be similar to the means for chest girth at armscye, so consequently were omitted from the tables 34 and 35.

TABLE 34.—Age means and standard deviations<sup>1</sup> for all measurements for boys aged 4 to 17

Measurement	Age 4			Age 5			Age 6			Age 7			Age 8			Age 9			Age 10		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
	Waist height	62.16	3.93	838	67.40	4.05	2,169	71.71	4.03	4,157	75.64	4.22	5,098	79.68	4.58	5,893	83.53	4.76	6,242	87.13	4.96
Hip height	49.27	3.40	838	53.74	3.43	2,169	57.40	3.43	4,157	60.82	3.62	5,098	64.25	3.91	5,893	67.57	4.08	6,242	70.67	4.24	6,646
Weight	38.58	4.81	838	43.19	5.85	2,169	47.78	6.39	4,157	52.64	7.12	5,098	58.29	8.71	5,893	63.29	9.70	6,242	70.37	11.48	6,646
Stature	104.07	5.34	838	111.89	5.57	2,169	117.81	5.48	4,157	123.26	5.63	5,098	128.67	6.06	5,893	133.79	6.22	6,242	138.47	6.50	6,646
Cervicale height	85.82	4.80	838	92.21	5.02	2,169	97.50	4.91	4,157	102.38	5.10	5,098	107.29	5.53	5,893	112.01	5.79	6,242	116.47	6.09	6,646
Tibiale height	27.12	1.95	838	29.50	2.07	2,169	31.37	2.01	4,157	33.20	2.13	5,098	34.97	2.27	5,893	36.66	2.35	6,242	38.29	2.49	6,646
Crotch height	43.64	3.33	838	47.99	3.29	2,169	51.42	3.25	4,157	54.65	3.45	5,098	57.76	3.70	5,893	60.82	3.84	6,242	63.67	3.99	6,646
Bitrochanteric diameter	19.66	1.13	838	20.55	1.26	2,169	21.29	1.25	4,157	22.10	1.37	5,098	23.02	1.52	5,893	23.92	1.60	6,242	24.84	1.77	6,646
Shoulder slope	25.83	4.17	838	25.99	4.11	2,169	25.84	4.23	4,145	25.60	4.06	5,094	25.39	4.00	5,885	25.14	3.89	6,239	24.99	3.81	6,645
Anterior chest width	20.04	1.42	838	20.77	1.54	2,169	21.55	1.63	4,157	22.34	1.64	5,095	23.29	1.77	5,893	24.19	1.83	6,239	25.05	1.94	6,643
Anterior waist length	22.37	1.51	838	23.38	1.62	2,169	24.39	1.63	4,157	25.29	1.62	5,098	26.13	1.71	5,892	26.90	1.71	6,242	27.51	1.79	6,644
Posterior chest width	23.58	1.77	838	24.76	1.80	2,169	25.72	1.79	4,156	26.52	1.84	5,097	27.36	1.96	5,893	28.18	2.00	6,241	28.90	2.10	6,643
Posterior waist length	24.39	1.63	837	25.52	1.69	2,168	26.64	1.70	4,156	27.65	1.74	5,093	28.59	1.80	5,890	29.55	1.83	6,239	30.40	1.93	6,642
Chest girth at armscye	56.60	2.85	838	58.40	2.94	2,169	60.24	3.05	4,157	62.25	3.29	5,098	64.45	3.65	5,893	66.64	3.88	6,242	68.79	4.35	6,646
Scye depth	11.76	1.23	837	12.45	1.28	2,168	13.01	1.33	4,155	13.50	1.36	5,093	13.99	1.38	5,894	14.46	1.47	6,237	14.89	1.47	6,640
Posterior hip arc	27.19	2.21	838	28.60	2.28	2,163	29.52	2.40	4,150	30.52	2.55	5,098	31.81	2.80	5,883	33.02	2.95	6,234	34.27	3.21	6,633
Anterior chest arc	29.18	1.98	836	30.52	2.12	2,167	31.41	2.23	4,151	32.55	2.37	5,093	33.84	2.57	5,896	35.02	2.69	6,230	36.26	2.86	6,636
Waist girth	51.57	2.98	838	52.60	2.94	2,169	53.67	3.03	4,157	54.84	3.15	5,098	56.25	3.51	5,893	57.66	3.82	6,242	59.01	4.26	6,646
Hip girth	55.86	3.22	838	58.22	3.62	2,169	60.33	3.69	4,157	62.56	3.94	5,098	65.09	4.43	5,893	67.67	4.73	6,242	70.14	5.25	6,646
Neck-base girth	27.73	1.53	838	28.72	1.54	2,169	29.27	1.46	4,137	30.03	1.49	5,098	30.78	1.62	5,893	31.52	1.60	6,242	32.16	1.69	6,646
Shoulder length	7.01	.79	837	7.36	.83	2,163	7.80	.83	4,155	8.14	.85	5,097	8.52	.87	5,891	8.87	.91	6,240	9.18	.94	6,646
Armscye girth	25.58	1.70	838	26.66	1.82	2,169	27.51	1.76	4,137	28.68	1.85	5,098	29.86	2.00	5,893	31.08	2.08	6,242	32.18	2.27	6,646
Upper-arm girth	16.58	1.21	838	16.99	1.30	2,169	17.28	1.37	4,157	17.78	1.45	5,098	18.37	1.65	5,893	19.04	1.75	6,242	19.70	1.98	6,646
Elbow girth	18.07	1.26	838	18.81	1.33	2,169	19.38	1.32	4,157	20.07	1.37	5,096	20.81	1.49	5,890	21.52	1.55	6,241	22.24	1.62	6,640
Upper posterior arm length	20.53	1.41	837	22.03	1.47	2,167	23.35	1.51	4,155	24.57	1.55	5,096	25.81	1.65	5,891	27.01	1.71	6,238	28.11	1.81	6,641
Total posterior arm length	36.51	2.33	838	39.17	2.36	2,169	41.39	2.40	4,157	43.55	2.48	5,098	45.72	2.66	5,893	47.85	2.79	6,242	49.82	2.95	6,646
Trunk line	12.52	1.36	838	13.17	1.49	2,169	13.93	1.46	4,153	14.50	1.49	5,098	14.97	1.54	5,893	15.48	1.55	6,240	15.90	1.61	6,645
Waist to hips	13.20	1.25	838	13.95	1.30	2,169	14.61	1.27	4,154	15.14	1.26	5,098	15.72	1.31	5,893	16.25	1.33	6,241	16.78	1.45	6,645
Thigh girth	31.73	2.41	838	33.07	2.74	2,169	34.14	2.75	4,157	35.46	2.97	5,098	36.96	3.41	5,893	38.66	3.64	6,242	40.21	4.08	6,646
Maximum calf girth	21.75	1.42	838	22.03	1.59	2,169	23.47	1.64	4,157	24.33	1.68	5,098	25.24	1.89	5,893	26.29	1.93	6,242	27.15	2.12	6,646
Knee girth	23.15	1.39	838	24.08	1.52	2,169	24.96	1.54	4,157	25.91	1.62	5,098	26.94	1.81	5,893	27.98	1.89	6,242	28.97	2.07	6,646
Total crotch length	45.37	2.86	838	47.16	3.14	2,169	49.00	3.20	4,157	50.70	3.27	5,098	52.69	3.53	5,893	54.67	3.79	6,242	56.44	3.95	6,646
Anterior crotch length	22.77	1.87	838	23.60	1.94	2,169	24.64	1.99	4,157	25.55	2.00	5,097	26.57	2.10	5,895	27.58	2.20	6,242	28.52	2.33	6,646
Extreme bend	44.01	2.89	837	46.62	3.15	2,164	48.90	3.11	4,152	51.22	3.21	5,091	53.67	3.46	5,888	56.10	3.59	6,239	58.33	3.74	6,640
Vertical trunk girth	96.57	4.57	838	100.61	4.89	2,169	104.45	4.88	4,157	108.05	4.98	5,098	111.82	5.49	5,893	115.57	5.71	6,242	119.04	6.23	6,646

<sup>1</sup> All measurements are given in centimeters except for weight which is given in pounds and for shoulder slope which is given in degrees.

TABLE 34.—Age means and standard deviations for all measurements for boys aged 4 to 17—Continued

Measurement	Age 11			Age 12			Age 13			Age 14			Age 15			Age 16			Age 17		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Waist height	90.54	5.15	6,488	94.33	5.48	6,612	98.32	5.78	6,255	102.20	5.84	4,777	106.67	5.45	4,702	108.68	5.19	4,017	109.62	5.01	2,771
Hip height	73.60	4.44	6,488	76.93	4.75	6,612	80.35	5.00	6,255	83.55	4.99	4,777	87.40	4.63	4,702	88.94	4.44	4,017	89.57	4.34	2,771
Weight	76.85	12.95	6,488	84.85	15.54	6,612	95.06	17.83	6,255	106.93	19.85	4,777	123.40	20.02	4,702	133.16	19.23	4,017	139.15	18.49	2,771
Stature	143.01	6.78	6,488	148.15	7.44	6,612	154.10	8.35	6,255	160.28	8.71	4,777	167.78	7.88	4,702	171.70	7.08	4,017	173.75	6.49	2,771
Cervicale height	120.73	6.36	6,488	125.59	6.98	6,612	131.06	7.73	6,255	136.72	8.01	4,777	143.54	7.26	4,702	147.06	6.57	4,017	148.89	6.11	2,771
Tibiale height	39.86	2.58	6,488	41.61	2.76	6,612	43.43	2.94	6,255	45.10	2.90	4,777	47.06	2.68	4,702	47.83	2.60	4,017	48.21	2.50	2,771
Crotch height	66.35	4.16	6,449	69.39	4.44	6,594	72.49	4.68	6,226	75.40	4.63	4,756	78.61	5.08	4,698	80.09	4.43	4,015	80.59	4.15	2,771
Bitrochanteric diameter	25.77	1.87	6,488	26.85	2.09	6,612	28.10	2.23	6,255	29.54	2.39	4,777	31.24	2.11	4,702	32.23	1.91	4,017	32.77	1.75	2,771
Shoulder slope	24.82	3.84	6,486	24.68	3.87	6,598	24.97	3.95	6,248	25.27	4.07	4,773	24.59	3.85	4,702	25.00	3.66	4,017	25.13	3.62	2,771
Anterior chest width	25.91	2.03	6,486	26.86	2.18	6,581	28.05	2.35	6,250	29.37	2.53	4,776	31.57	2.40	4,702	32.76	2.23	4,017	33.59	2.18	2,771
Anterior waist length	28.18	1.80	6,486	28.92	1.95	6,607	30.06	2.27	6,252	31.37	2.43	4,771	33.12	2.42	4,702	34.18	2.22	4,017	34.79	2.12	2,771
Posterior chest width	29.63	2.16	6,478	30.42	2.31	6,611	31.56	2.57	6,249	32.79	2.81	4,770	34.72	2.66	4,702	35.87	2.56	4,017	36.64	2.46	2,771
Posterior waist length	31.30	1.97	6,482	32.35	2.22	6,607	33.36	2.60	6,249	35.60	2.97	4,770	37.60	2.76	4,702	39.09	2.50	4,017	40.04	2.31	2,771
Chest girth at armsye	71.00	4.63	6,488	73.53	5.17	6,612	76.65	5.66	6,255	80.24	6.22	4,777	85.59	6.12	4,702	88.68	5.84	4,017	90.86	5.46	2,771
Sye depth	15.37	1.50	6,482	15.94	1.61	6,607	16.62	1.73	6,251	17.39	1.86	4,774	18.66	1.69	4,702	19.28	1.64	4,017	19.66	1.63	2,771
Posterior hip arc	35.47	3.39	6,475	36.81	3.55	6,598	38.23	3.90	6,244	39.87	3.83	4,761	42.52	3.63	4,702	43.88	3.41	4,017	44.71	3.34	2,771
Anterior chest arc	37.48	3.08	6,475	38.90	3.31	6,602	40.60	3.56	6,237	42.50	3.75	4,764	45.14	3.54	4,702	46.79	3.40	4,017	47.96	3.27	2,771
Waist girth	60.53	4.62	6,488	62.20	5.06	6,612	64.07	5.05	6,255	66.21	5.18	4,777	68.87	5.31	4,702	70.57	5.25	4,017	71.78	5.20	2,770
Hip girth	72.63	5.56	6,488	75.53	6.06	6,612	78.81	6.36	6,255	82.47	6.59	4,777	87.07	6.12	4,702	89.81	5.59	4,017	91.39	5.23	2,771
Neck-base girth	32.83	1.74	6,488	33.67	1.91	6,612	34.82	2.21	6,255	36.16	2.42	4,777	38.83	2.46	4,702	40.01	2.25	4,017	40.78	2.14	2,771
Shoulder length	9.49	0.96	6,483	9.82	1.00	6,610	10.27	1.09	6,252	10.75	1.21	4,776	11.37	1.16	4,702	11.78	1.13	4,017	12.08	1.10	2,771
Armsye girth	33.37	2.36	6,488	34.73	2.65	6,612	36.48	2.98	6,255	38.41	3.19	4,777	40.41	2.88	4,702	41.97	2.64	4,017	42.95	2.57	2,771
Upper-arm girth	20.39	2.09	6,488	21.18	2.28	6,612	22.15	2.38	6,255	23.24	2.49	4,777	24.95	2.43	4,702	26.01	2.38	4,017	26.80	2.32	2,771
Elbow girth	22.99	1.68	6,472	23.90	1.84	6,602	25.03	2.02	6,244	26.28	2.11	4,769	27.48	2.07	4,702	28.33	1.94	4,017	28.93	1.84	2,771
Upper posterior arm length	29.22	1.85	6,485	30.46	2.02	6,609	31.77	2.15	6,247	33.13	2.25	4,774	34.82	2.11	4,702	35.72	1.97	4,017	36.22	1.92	2,771
Total posterior arm length	51.76	3.05	6,488	53.97	3.30	6,612	56.37	3.55	6,255	58.86	3.69	4,777	61.79	3.42	4,702	63.35	3.16	4,017	64.11	3.04	2,771
Trunk line	16.28	1.64	6,487	16.81	1.70	6,608	17.54	1.90	6,250	18.44	2.02	4,774	19.65	1.94	4,702	20.43	1.84	4,017	20.88	1.85	2,771
Waist to hips	17.26	1.53	6,488	17.79	1.60	6,611	18.49	1.75	6,253	19.32	1.88	4,775	19.97	1.73	4,702	20.50	1.70	4,017	20.82	1.66	2,771
Thigh girth	41.81	4.31	6,488	43.49	4.65	6,612	45.31	4.63	6,255	47.12	4.66	4,777	49.67	4.44	4,702	51.19	4.39	4,017	52.09	4.26	2,771
Maximum calf girth	28.08	2.26	6,488	29.20	2.49	6,612	30.52	2.65	6,255	31.86	2.72	4,777	33.56	2.50	4,702	34.45	2.40	4,017	35.01	2.41	2,771
Knee girth	29.89	2.20	6,488	31.19	2.40	6,612	32.44	2.46	6,255	33.59	2.39	4,777	34.86	2.14	4,702	35.40	2.09	4,017	35.65	2.01	2,771
Total crotch length	58.29	4.25	6,488	60.64	4.67	6,612	63.50	5.16	6,255	66.60	5.28	4,777	70.38	4.84	4,702	72.30	4.32	4,017	73.37	4.09	2,771
Anterior crotch length	29.53	2.51	6,486	30.79	2.75	6,602	32.45	3.01	6,251	34.26	3.09	4,775	36.00	2.54	4,702	37.03	2.47	4,017	37.54	2.36	2,771
Extreme bend	60.40	3.86	6,481	62.78	4.11	6,610	65.37	4.34	6,252	68.05	4.52	4,776	71.39	4.24	4,702	73.16	3.96	4,017	74.14	3.77	2,771
Vertical trunk girth	122.68	6.74	6,488	127.13	7.65	6,612	132.99	9.01	6,255	139.56	9.75	4,777	147.42	8.81	4,702	152.20	7.64	4,017	155.19	6.85	2,771

TABLE 35.—Age means and standard deviations <sup>1</sup> for all measurements for girls aged 4 to 17

Measurement	Age 4			Age 5			Age 6			Age 7			Age 8			Age 9			Age 10			
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	
Waist height	62.60	3.93	1,007	67.60	4.02	2,596	71.89	4.13	4,559	75.92	4.32	5,367	80.04	4.65	5,754	83.81	4.81	6,174	87.97	4.99	6,253	
Hip height	49.56	3.40	1,007	53.81	3.47	2,596	57.52	3.51	4,559	60.91	3.71	5,367	64.39	3.94	5,754	67.53	4.10	6,174	70.97	4.22	6,253	
Weight	37.50	4.96	1,007	41.81	5.98	2,596	46.46	6.86	4,559	51.54	8.00	5,367	57.11	9.39	5,754	63.06	11.06	6,174	70.19	12.91	6,253	
Stature	104.36	5.23	1,007	110.87	5.47	2,596	116.81	5.53	4,559	122.19	5.69	5,367	127.71	6.07	5,754	132.66	6.29	6,174	138.19	6.65	6,253	
Cervicale height	85.73	4.75	1,007	91.72	4.93	2,596	97.08	4.97	4,559	101.89	5.17	5,367	106.89	5.59	5,754	111.53	5.89	6,174	116.73	6.26	6,253	
Tibiale height	27.32	1.96	1,006	29.56	2.04	2,596	31.54	2.14	4,559	33.32	2.16	5,367	35.15	2.28	5,754	36.77	2.41	6,174	38.60	2.46	6,253	
Crotch height	43.61	3.24	1,002	47.75	3.26	2,579	51.19	3.32	4,532	54.32	3.42	5,322	57.56	3.71	5,703	60.38	3.84	6,172	63.57	3.97	6,217	
Bitrochanteric diameter	19.68	1.24	1,007	20.53	1.36	2,596	21.41	1.46	4,559	22.29	1.57	5,367	23.21	1.68	5,754	24.17	1.86	6,174	25.32	2.03	6,253	
Shoulder slope	25.98	4.03	1,007	25.61	4.43	2,589	25.59	4.26	4,539	25.59	4.29	5,352	25.44	4.13	5,746	25.16	4.13	6,157	25.09	4.11	6,232	
Anterior chest width	19.96	1.44	1,006	20.71	1.52	2,596	21.53	1.60	4,558	22.38	1.66	5,364	23.31	1.78	5,750	24.19	1.86	6,172	25.12	1.97	6,250	
Anterior waist length	22.02	1.51	1,007	22.91	1.61	2,595	23.93	1.61	4,556	24.73	1.64	5,362	25.56	1.66	5,754	26.23	1.67	6,166	27.03	1.80	6,250	
Posterior chest width	24.34	1.71	1,004	24.24	1.75	2,596	25.17	1.79	4,558	26.05	1.86	5,364	26.86	1.91	5,751	27.69	2.03	6,170	28.61	2.18	6,250	
Posterior waist length	23.97	1.55	1,007	24.93	1.64	2,596	26.09	1.67	4,557	26.96	1.66	5,364	27.96	1.74	5,750	28.83	1.82	6,172	29.97	1.99	6,250	
Chest girth at armsye	55.48	2.81	1,007	57.16	3.05	2,596	58.97	3.29	4,559	61.00	3.60	5,367	63.10	4.04	5,754	65.29	4.49	6,174	67.76	5.06	6,253	
Sye depth	11.64	1.29	1,007	12.25	1.30	2,595	12.75	1.34	4,556	13.19	1.37	5,363	13.72	1.40	5,748	14.17	1.46	6,170	14.69	1.48	6,252	
Posterior hip arc	27.80	2.31	1,006	29.10	2.48	2,591	30.24	2.66	4,556	31.47	2.90	5,360	32.67	3.04	5,744	34.02	3.36	6,164	35.53	3.65	6,239	
Maximum chest girth	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Anterior chest arc	28.67	2.02	1,005	29.90	2.17	2,594	30.88	2.35	4,554	32.04	2.60	5,356	33.33	2.83	5,745	34.50	3.09	6,168	35.88	3.26	6,241	
Waist girth	50.22	2.88	1,007	51.08	3.11	2,596	52.05	3.41	4,559	53.32	3.68	5,367	54.68	4.10	5,754	56.17	4.53	6,174				

TABLE 35.—Age means and standard deviations for all measurements for girls aged 4 to 17—Continued

Measurement	Age 11			Age 12			Age 13			Age 14			Age 15			Age 16			Age 17		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Waist height.....	92.12	5.34	6,132	96.13	5.25	5,865	99.12	4.74	5,133	100.83	4.50	3,633	102.09	4.32	3,991	102.22	4.36	3,329	102.18	4.53	2,115
Hip height.....	74.38	4.48	6,132	77.57	4.42	5,865	79.84	4.15	5,133	80.95	4.08	3,633	82.17	3.95	3,991	82.20	3.97	3,329	82.19	4.09	2,115
Weight.....	78.77	15.01	6,132	89.08	17.01	5,865	98.88	17.18	5,133	106.17	15.98	3,633	114.20	15.03	3,991	116.69	14.73	3,329	117.46	15.05	2,115
Stature.....	144.11	7.34	6,132	150.14	7.47	5,865	154.98	6.75	5,133	157.90	6.14	3,633	160.49	5.78	3,991	161.08	5.74	3,329	161.13	5.94	2,115
Cervicale height.....	122.27	6.85	6,132	127.85	6.95	5,865	132.34	6.24	5,133	135.08	5.69	3,633	137.29	5.38	3,991	137.74	5.42	3,329	137.82	5.63	2,115
Tibiale height.....	40.44	2.66	6,132	42.11	2.57	5,865	43.30	2.44	5,133	43.82	2.36	3,633	44.34	2.31	3,991	44.35	2.34	3,329	44.31	2.35	2,115
Crotch height.....	66.69	4.20	6,091	69.57	4.17	5,832	71.53	3.92	5,100	72.50	3.91	3,614	73.29	3.83	3,990	73.31	3.83	3,329	73.30	3.91	2,115
Bitrocanteric diameter.....	26.67	2.29	6,132	28.36	2.49	5,865	29.99	2.44	5,133	31.17	2.19	3,633	32.18	1.90	3,991	32.55	1.80	3,329	32.72	1.89	2,115
Shoulder slope.....	25.12	4.01	6,112	24.90	4.10	5,849	24.97	4.08	5,125	25.05	4.10	3,630	24.40	3.89	3,991	24.22	3.83	3,329	24.15	3.79	2,115
Anterior chest width.....	28.05	2.05	6,129	27.29	2.14	5,861	28.27	2.12	5,128	29.05	1.99	3,626	30.25	1.85	3,991	30.61	1.62	3,329	30.68	1.70	2,115
Anterior waist length.....	29.63	1.97	6,129	29.10	2.07	5,861	30.20	2.06	5,128	30.93	1.99	3,626	31.92	1.82	3,991	32.34	1.77	3,329	32.51	1.80	2,115
Posterior chest width.....	29.63	2.38	6,125	30.90	2.55	5,858	31.93	2.51	5,128	32.59	2.49	3,627	32.91	2.25	3,991	33.12	2.22	3,329	33.16	2.20	2,115
Posterior waist length.....	31.46	2.24	6,123	33.04	2.44	5,858	34.57	2.35	5,125	35.63	2.20	3,627	36.04	1.96	3,991	36.43	1.93	3,329	36.56	1.97	2,115
Chest girth at armscye.....	70.68	5.42	6,132	74.00	5.83	5,865	76.92	5.63	5,133	79.06	5.19	3,633	81.95	4.74	3,991	82.66	4.58	3,329	82.86	4.60	2,115
Scye depth.....	15.32	1.61	6,131	15.95	1.74	5,858	16.63	1.76	5,130	17.08	1.77	3,630	18.01	1.40	3,991	18.18	1.45	3,329	18.21	1.41	2,115
Posterior hip arc.....	37.26	4.06	6,117	39.59	4.35	5,855	41.89	4.41	5,117	43.62	4.08	3,624	44.72	3.59	3,991	45.29	3.29	3,329	45.57	3.36	2,115
Maximum chest girth.....	70.82	5.70	5,949	74.63	6.42	5,817	78.13	6.21	5,121	80.79	5.77	3,623	83.77	5.18	3,991	84.36	5.04	3,329	84.49	4.94	2,115
Anterior chest arc.....	37.43	3.42	6,126	39.09	3.66	5,853	40.60	3.75	5,123	41.89	3.45	3,629	43.95	2.93	3,991	44.39	2.84	3,329	44.57	2.82	2,115
Waist girth.....	59.54	5.13	6,132	61.36	5.23	5,865	62.75	5.01	5,133	63.70	4.85	3,633	64.30	4.58	3,991	64.54	4.60	3,329	64.58	4.55	2,115
Hip girth.....	75.53	6.67	6,132	79.96	7.20	5,865	84.31	7.12	5,133	87.60	6.30	3,633	90.81	5.54	3,991	91.91	5.15	3,329	92.34	5.31	2,115
Neck-base girth.....	32.53	1.92	6,132	33.67	1.97	5,865	34.67	1.94	5,133	35.31	1.76	3,633	36.35	1.60	3,991	36.61	1.56	3,329	36.62	1.59	2,115
Shoulder length.....	9.88	0.99	6,129	10.28	1.06	5,862	10.62	1.04	5,131	10.88	1.02	3,630	10.99	0.94	3,991	11.09	0.94	3,329	11.10	0.91	2,115
Armscye girth.....	32.63	2.55	6,132	34.11	2.67	5,865	35.47	2.65	5,133	36.49	2.49	3,633	37.27	2.09	3,991	37.59	2.01	3,329	37.64	1.98	2,115
Upper-arm girth.....	20.65	2.45	6,132	21.49	2.42	5,865	22.40	2.44	5,133	23.18	2.37	3,633	24.38	2.21	3,991	24.67	2.13	3,329	24.82	2.23	2,115
Elbow girth.....	22.67	1.82	6,124	23.60	1.82	5,855	24.37	1.75	5,123	24.94	1.68	3,630	25.19	1.54	3,991	25.33	1.52	3,329	25.32	1.56	2,115
Upper posterior arm length.....	70.54	1.95	6,127	30.94	1.95	5,860	32.05	1.90	5,135	32.73	1.77	3,626	33.49	1.70	3,991	33.53	1.73	3,329	33.58	1.77	2,115
Total posterior arm length.....	52.00	3.20	6,132	54.43	3.29	5,865	56.33	2.98	5,133	57.44	2.84	3,633	58.62	2.75	3,991	58.71	2.75	3,329	58.67	2.81	2,115
Trunk line.....	16.35	1.75	6,132	17.22	1.80	5,863	17.94	1.79	5,130	18.47	1.83	3,633	19.07	1.62	3,991	19.35	1.58	3,329	19.49	1.59	2,115
Waist to hips.....	18.27	1.89	6,131	19.24	1.98	5,862	20.20	2.00	5,131	20.92	1.97	3,630	21.01	1.72	3,991	21.17	1.75	3,329	21.19	1.77	2,115
Thigh girth.....	43.65	4.77	6,132	45.94	5.07	5,865	47.82	5.20	5,133	50.23	4.84	3,633	52.39	3.85	3,991	53.18	4.10	3,329	53.53	4.11	2,115
Maximum calf girth.....	28.55	2.39	6,132	29.81	2.54	5,865	31.01	2.54	5,133	31.90	2.41	3,633	32.78	2.21	3,991	33.16	2.18	3,329	33.27	2.19	2,115
Knee girth.....	30.26	2.36	6,132	31.56	2.42	5,865	32.59	2.38	5,133	33.29	2.26	3,633	33.80	2.09	3,991	33.98	2.06	3,329	33.99	2.11	2,115
Total crotch length.....	60.19	4.76	6,132	62.93	5.02	5,865	65.44	4.92	5,133	67.27	4.46	3,633	69.51	3.95	3,991	69.90	3.75	3,329	70.07	3.79	2,115
Anterior crotch length.....	29.68	2.64	6,128	31.04	2.87	5,856	32.13	2.76	5,124	32.88	2.62	3,628	34.60	2.42	3,991	34.75	2.30	3,329	34.86	2.34	2,115
Extreme bend.....	62.98	4.26	6,124	65.92	4.50	5,858	68.56	4.33	5,122	70.41	3.98	3,630	71.58	3.49	3,991	71.92	3.24	3,329	71.92	3.47	2,115
Vertical trunk girth.....	125.29	7.72	6,132	129.07	8.13	5,865	134.26	7.71	5,133	138.08	6.91	3,633	141.62	6.13	3,991	142.63	5.90	3,329	142.93	5.95	2,115

Mean measurements of children at different age levels are shown in figure 29. It will be noticed from this figure, that, up to about age 11, boys are on the average taller and weigh more than girls. From age 11 to about 13½ the situation is reversed. From about 13½ to 17 the rate of growth in height and weight decreases much more rapidly for the girls than for the boys. The girls have a larger hip measure than the boys for practically all ages considered. The comparative average rate of growth for boys and girls with respect to chest girth is somewhat similar to that of stature or weight.

Similar conclusions may be drawn from table 36 which gives the means, mean differences, and standard error of the mean differences for eight measurements for boys and girls aged 4 to 17, inclusive. These, however, are computed from 12-month intervals. It is interesting to note that with the exception of hip girth, the actual mean differences between boys and girls with respect to the measurements considered are quite small for the younger children. The significance of these differences may be seen from the size of the standard error of the mean differences given in table 36.

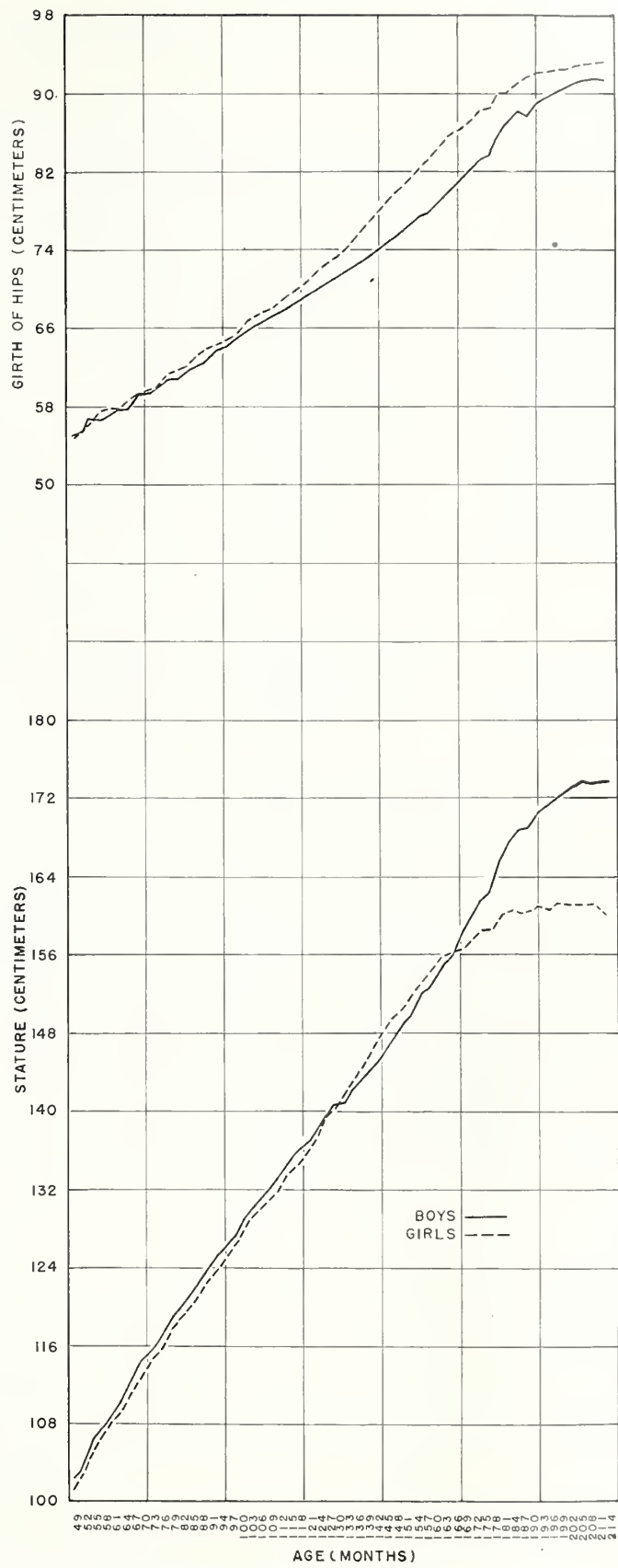
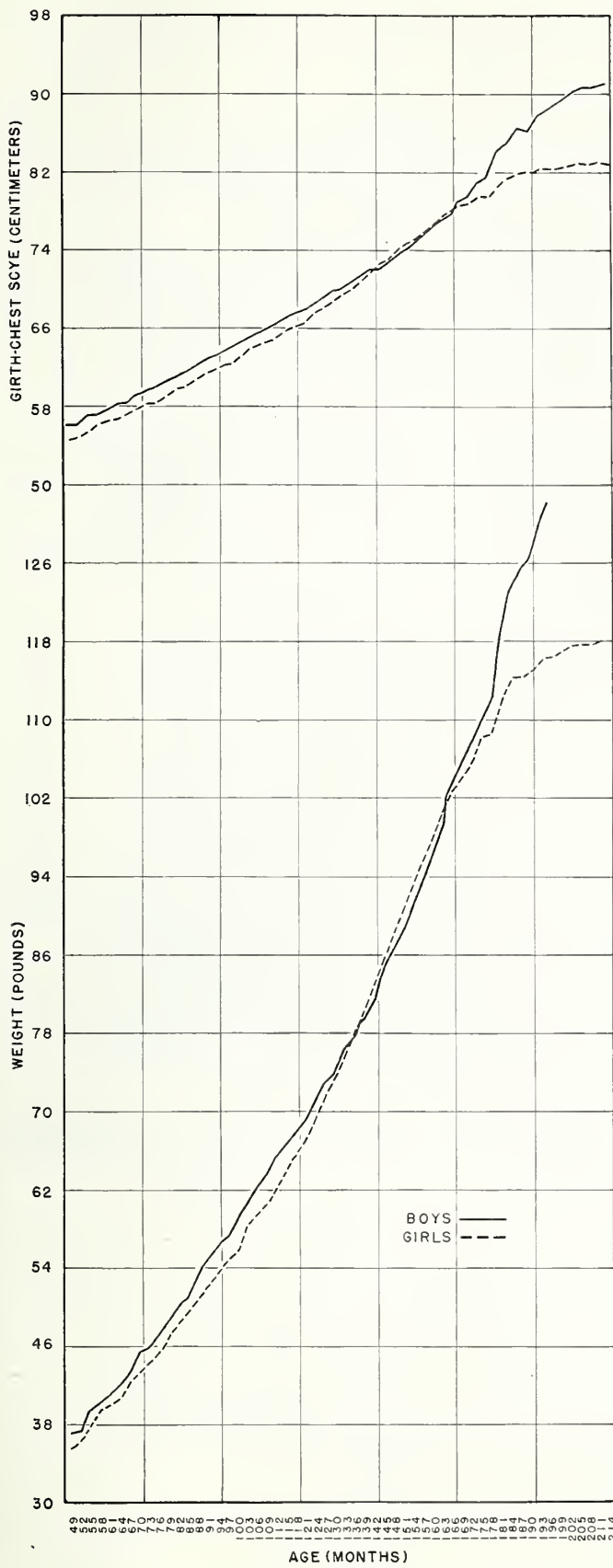


FIGURE 29.—Mean measurements of children at intervals of 3 months.

TABLE 36.—The means for 8 measurements for boys and girls, the differences between these means, and the standard error of these differences

Measurement	Age 4				Age 5				Age 6				Age 7				Age 8			
	Boys, mean	Girls, mean	Difference	Standard error of difference	Boys, mean	Girls, mean	Difference	Standard error of difference	Boys, mean	Girls, mean	Difference	Standard error of difference	Boys, mean	Girls, mean	Difference	Standard error of difference	Boys, mean	Girls, mean	Difference	Standard error of difference
Hip height.....	49.27	49.56	-0.29	0.16	53.74	53.81	-0.07	0.10	57.40	57.52	-0.12	0.07	60.82	60.91	-0.09	0.07	64.25	64.39	-0.14	0.07
Weight.....	38.58	37.50	1.08	.23	43.19	41.81	1.38	.17	47.78	46.46	1.32	.14	52.64	51.54	1.10	.15	58.29	57.11	1.18	.17
Stature.....	104.97	104.36	.61	.25	111.89	110.87	1.02	.16	117.81	116.81	1.00	.12	123.26	122.19	1.07	.11	128.67	127.71	.96	.11
Cervicale height.....	85.82	85.73	.09	.22	92.21	91.72	.49	.14	97.50	97.18	.32	.11	102.38	101.98	.40	.10	107.29	106.98	.31	.10
Tibiale height.....	27.12	27.32	-.20	.13	29.50	29.56	-.06	.08	31.37	31.54	-.17	.04	33.20	33.32	-.12	.04	34.97	35.15	-.18	.04
Chest girth at armseye.....	56.60	55.48	1.12	.13	58.40	57.16	1.24	.09	60.24	58.97	1.27	.07	62.25	60.99	1.26	.07	64.45	63.10	1.35	.07
Hip girth.....	55.86	56.20	-.34	.16	58.22	58.56	-.34	.11	60.33	60.89	-.56	.08	62.56	63.42	-.86	.07	65.09	66.02	-.93	.09
Total posterior arm length.....	36.51	36.11	.40	.11	39.17	38.52	.65	.07	41.39	40.74	.65	.05	43.55	42.87	.68	.05	45.72	45.14	.58	.05
Age 9																				
Hip height.....	67.57	67.53	0.04	0.07	70.67	70.97	-0.30	0.07	73.60	74.38	-0.78	0.08	76.93	77.57	-0.64	0.08	80.35	79.84	0.51	0.09
Weight.....	64.29	63.06	1.23	.19	70.37	70.19	.18	.22	76.85	78.77	-1.92	.25	84.85	89.08	-4.23	.29	95.06	98.88	-3.82	.33
Stature.....	133.79	132.66	1.13	.11	138.47	138.19	.28	.12	143.01	144.11	-1.10	.13	148.15	150.14	-1.99	.13	154.10	154.98	-.88	.14
Cervicale height.....	112.01	111.62	.39	.11	116.47	116.81	-.34	.11	120.73	122.35	-1.62	.12	125.59	127.97	-2.38	.13	131.06	132.46	-1.40	.13
Tibiale height.....	36.66	36.77	-.11	.04	38.29	38.60	-.31	.04	39.86	40.44	-.58	.05	41.61	42.11	-.50	.05	43.43	43.30	.13	.05
Chest girth at armseye.....	66.64	65.29	1.35	.08	68.79	67.76	1.03	.08	71.00	70.68	.32	.09	73.53	74.00	-.47	.20	76.65	76.92	-.27	.11
Hip girth.....	67.67	68.77	-1.10	.09	70.14	71.88	-1.74	.10	72.63	75.53	-2.90	.11	75.53	79.96	-4.43	.12	78.81	84.31	-5.50	.13
Total posterior arm length.....	47.85	47.21	.64	.05	49.82	49.53	.29	.05	51.76	52.00	-.24	.06	53.97	54.43	-.46	.06	56.37	56.33	.04	.06
Age 14																				
Hip height.....	83.55	80.95	2.60	0.10	87.40	82.17	5.23	0.09	88.94	82.20	6.74	0.10	89.52	82.19	7.33	0.12				
Weight.....	106.93	106.17	.76	.39	123.40	114.20	9.20	.38	133.16	116.69	16.47	.40	139.15	117.46	21.69	.48				
Stature.....	160.27	157.90	2.37	.16	167.78	160.49	7.29	.15	171.70	161.08	10.62	.15	173.75	161.13	12.62	.18				
Cervicale height.....	136.72	135.21	1.51	.15	143.54	137.29	6.25	.14	147.06	137.74	9.32	.14	148.89	137.82	11.07	.17				
Tibiale height.....	45.10	43.82	1.28	.06	47.06	44.34	2.72	.05	47.83	44.35	3.48	.06	48.21	44.31	3.90	.07				
Chest girth at armseye.....	80.24	79.06	1.18	.12	85.59	81.95	3.64	.12	88.68	82.66	6.02	.12	90.86	82.86	8.00	.15				
Hip girth.....	82.47	87.60	-5.13	.14	87.07	90.81	-3.74	.13	89.81	91.91	-2.10	.13	91.39	92.34	-.95	.15				
Total posterior arm length.....	58.86	57.44	1.42	.07	61.79	58.62	3.17	.07	63.35	58.71	4.64	.07	64.11	58.67	5.44	.08				

Coefficients of Variation

As can be seen from tables 34 and 35 the standard deviations for most body measurements of young children increase with age. However, the relative variation behaves in a different manner. Thus, figure 30 gives the coefficient of variation (i. e. the standard deviation times 100 divided by the mean) for the 8 measurements considered in table 36. It will be noted from these diagrams that the coefficient of variation shows a different growth pattern for the lengths than for the girths and weights. By comparing the increases and decreases of the coefficient of variation for both sexes, it will be seen that the growth pattern of the coefficient of variations is related to the rate of maturation.

Coefficients of Correlation

The correlation coefficients for seven measurements for each of the age groups 6 to 17, inclusive, are presented in table 37. The correlations for the sample of boys are given above the main diagonal of the matrix and those for the girls below the main diagonal. Statistical tests of significance<sup>28</sup> showed that all the correlations are significantly different from zero, and that, with few exceptions, the intercorrelations of the measurements for boys do not differ significantly from those of the girls.

<sup>28</sup> The correlations were converted into z values which were then treated as normally distributed variates with variance equal to 1/N-3 where N is the number of cases in the sample.

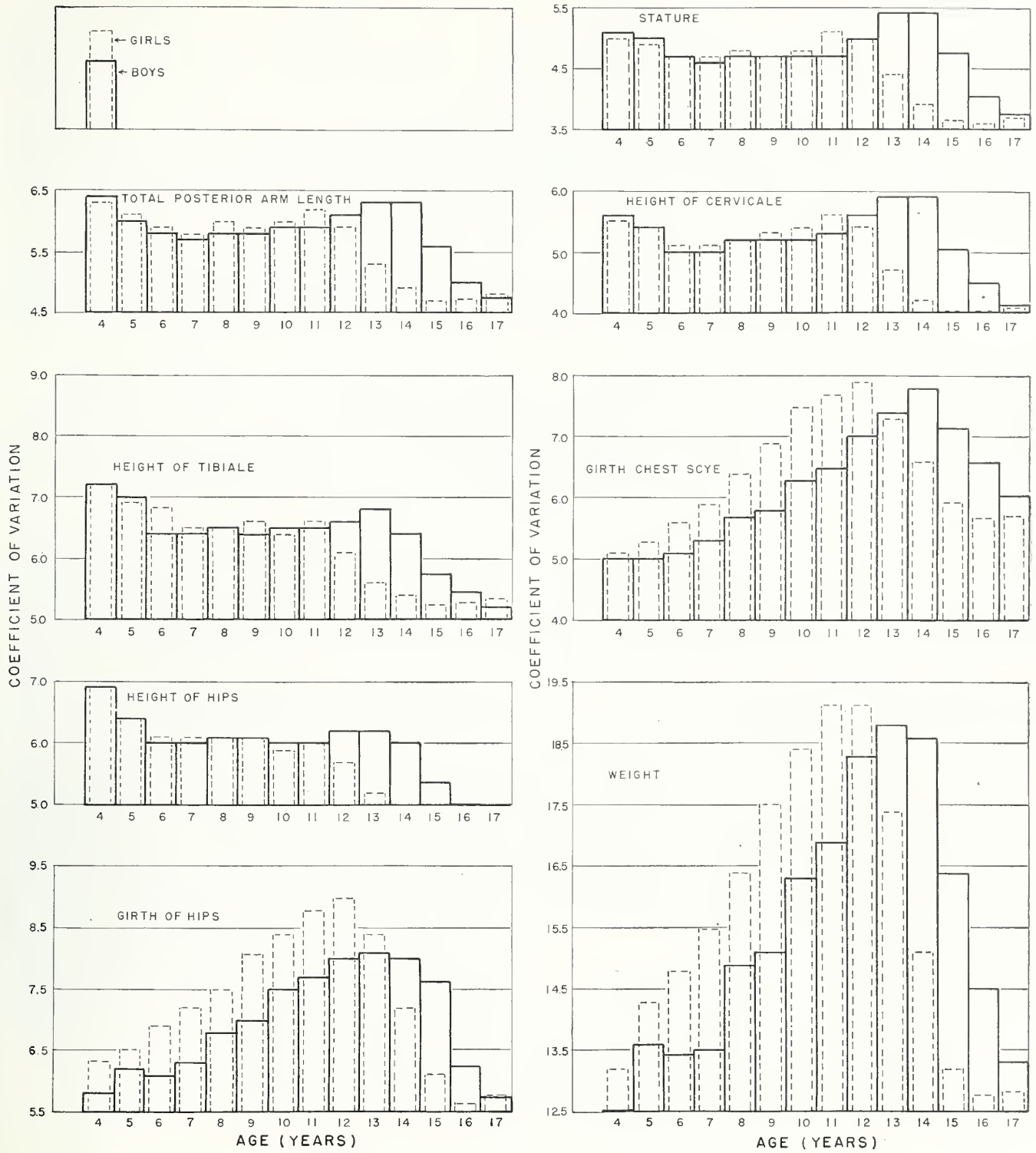


FIGURE 30.—Coefficient of variation for eight measurements.





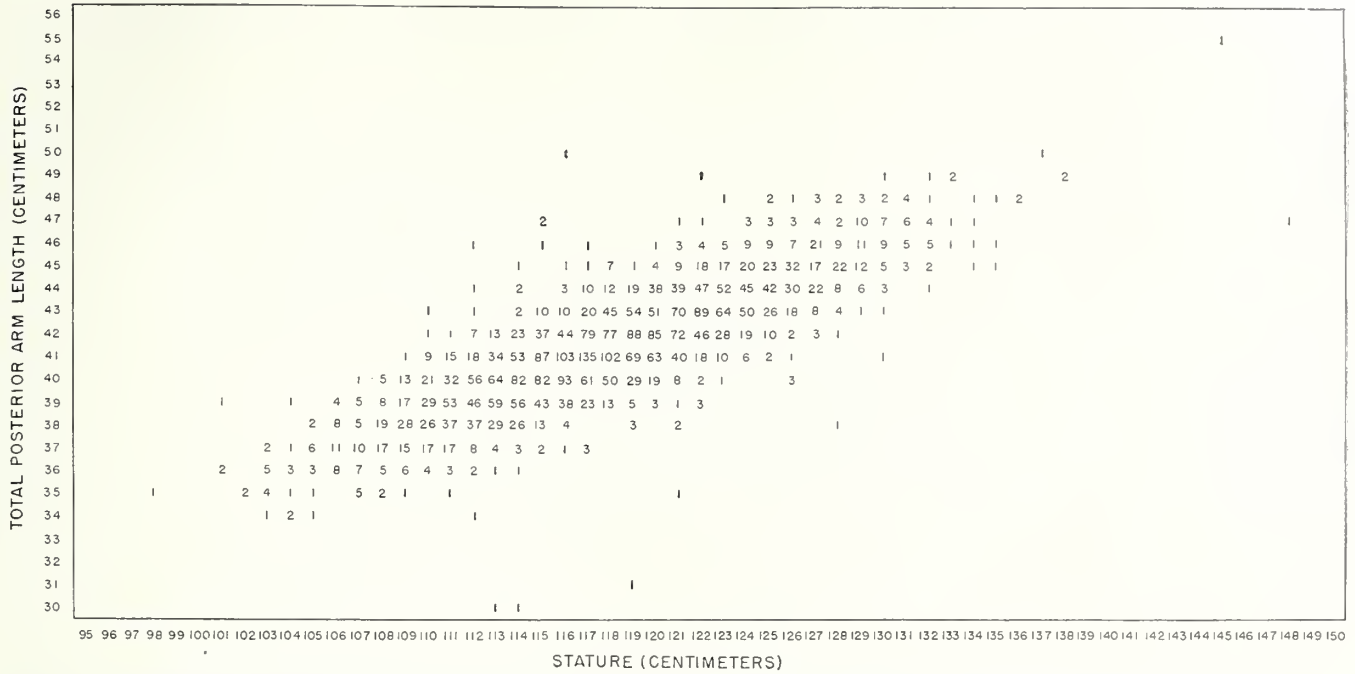


FIGURE 31.—Distribution of 4,157 6-year-old boys on basis of stature and total posterior arm length.

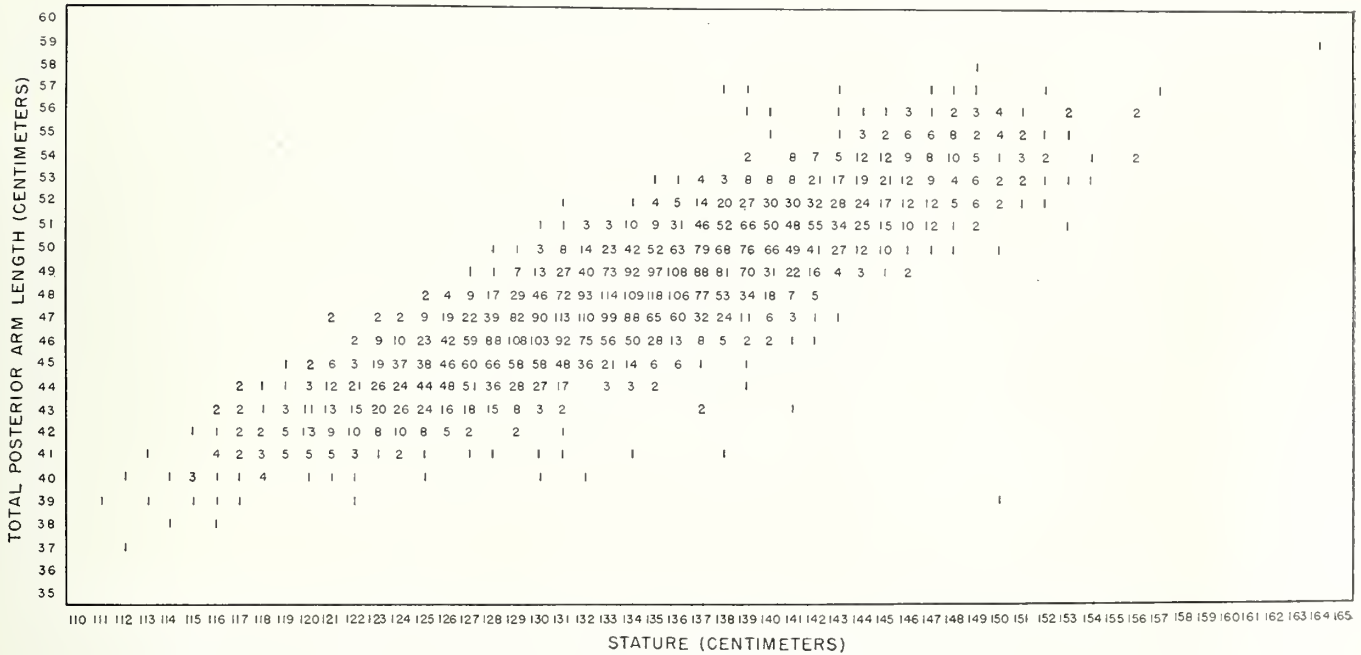


FIGURE 32.—Distribution of 6,242 9-year-old boys on basis of stature and total posterior arm length.

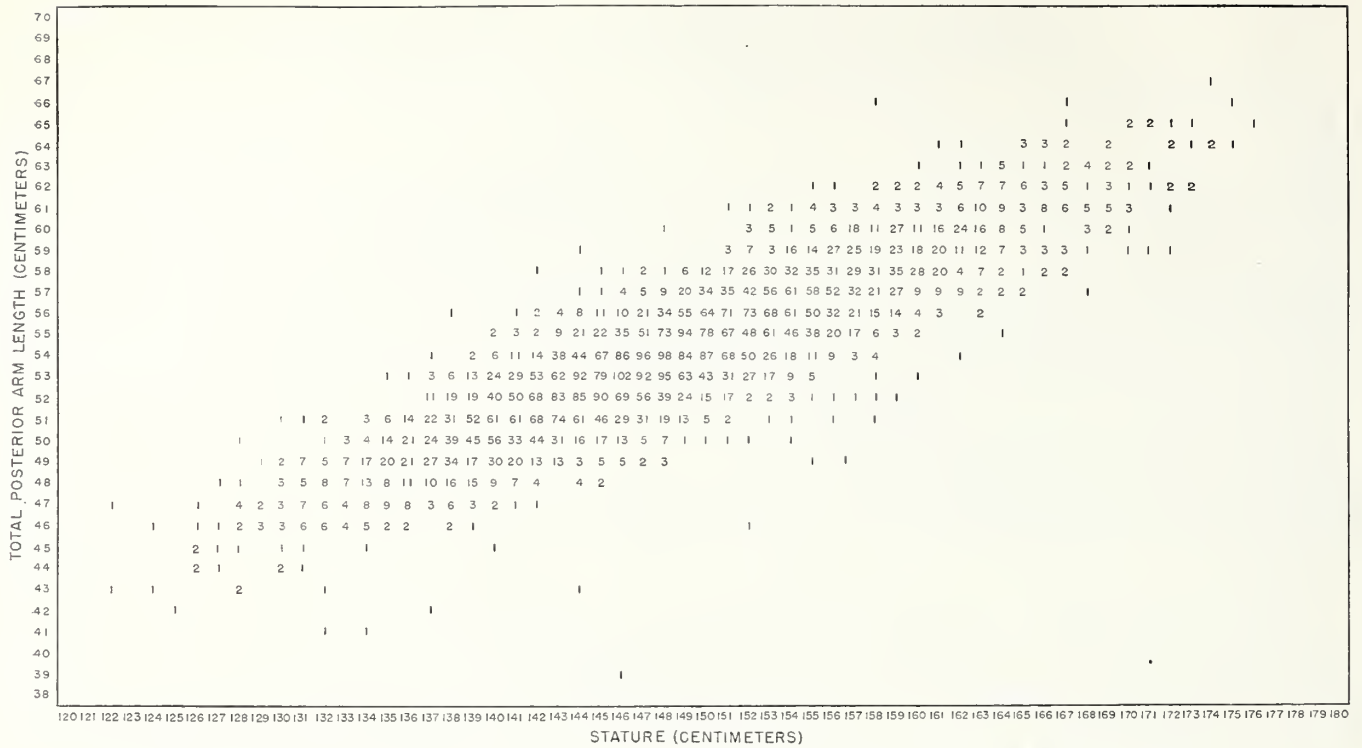


FIGURE 33.—Distribution of 6,612 12-year-old boys on basis of stature and total posterior arm length.

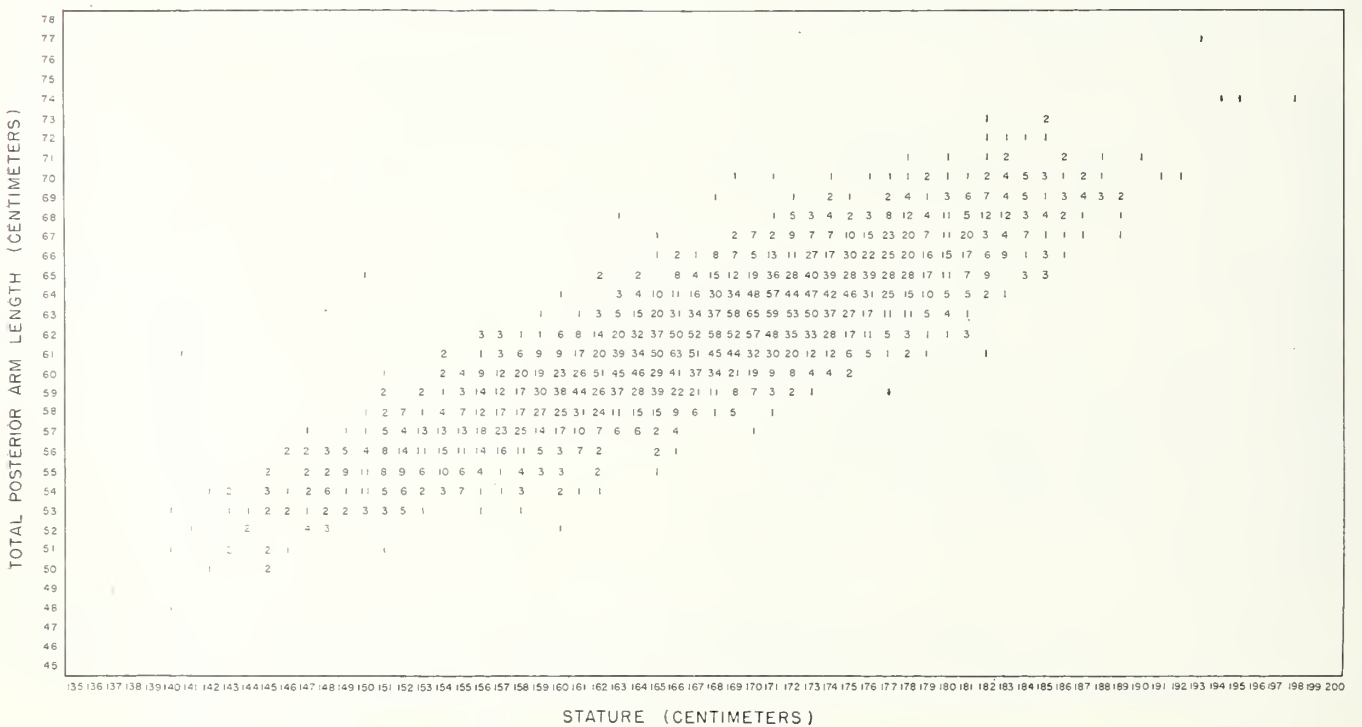


FIGURE 34.—Distribution of 4,702 15-year-old boys on basis of stature and total posterior arm length.

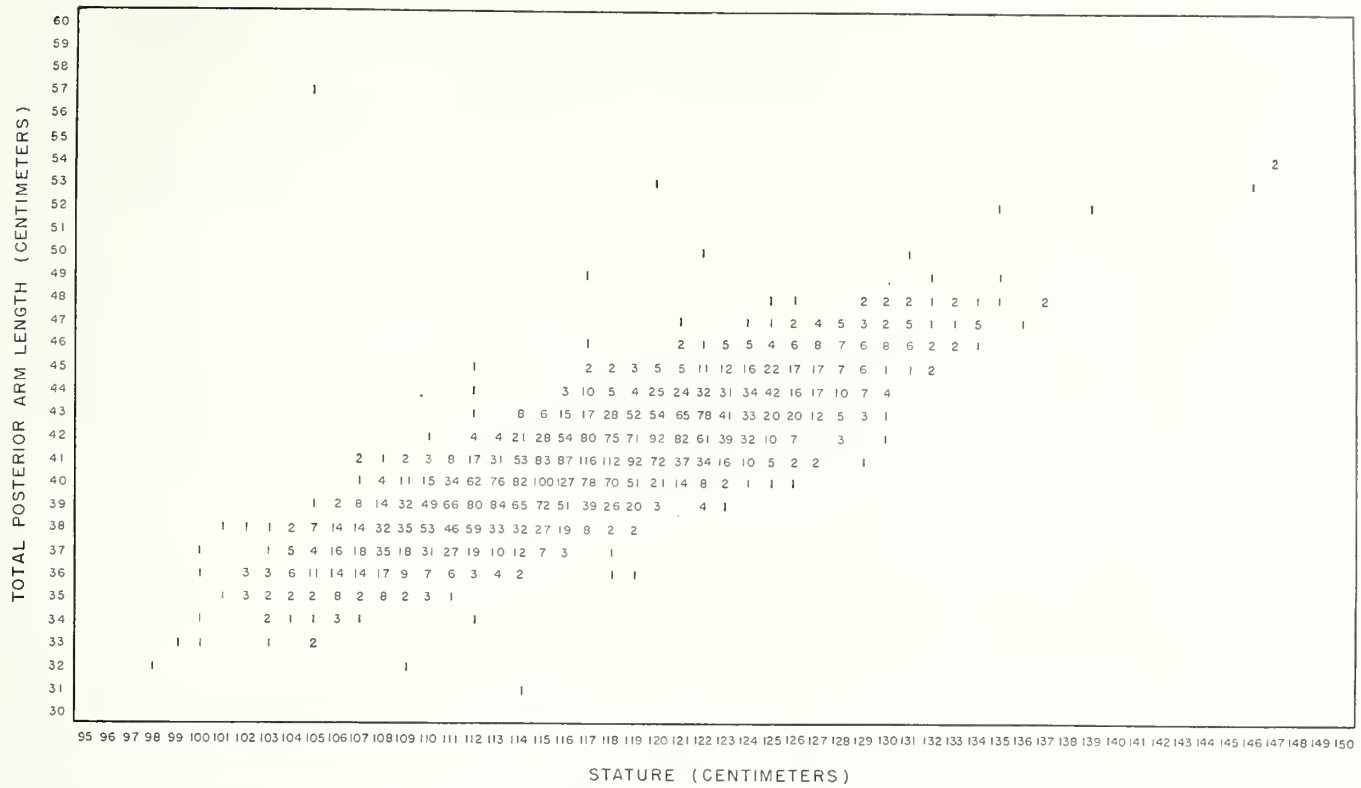


FIGURE 35.—Distribution of 4,559 6-year-old girls on basis of stature and total posterior arm length.

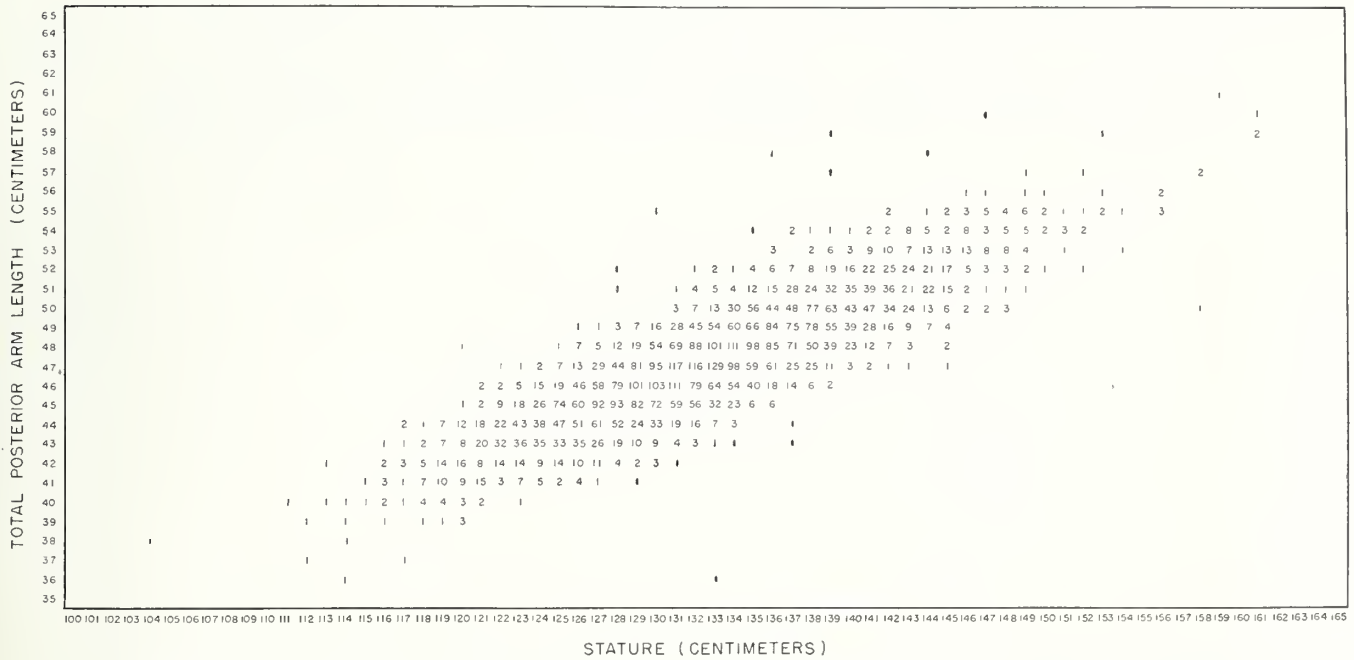
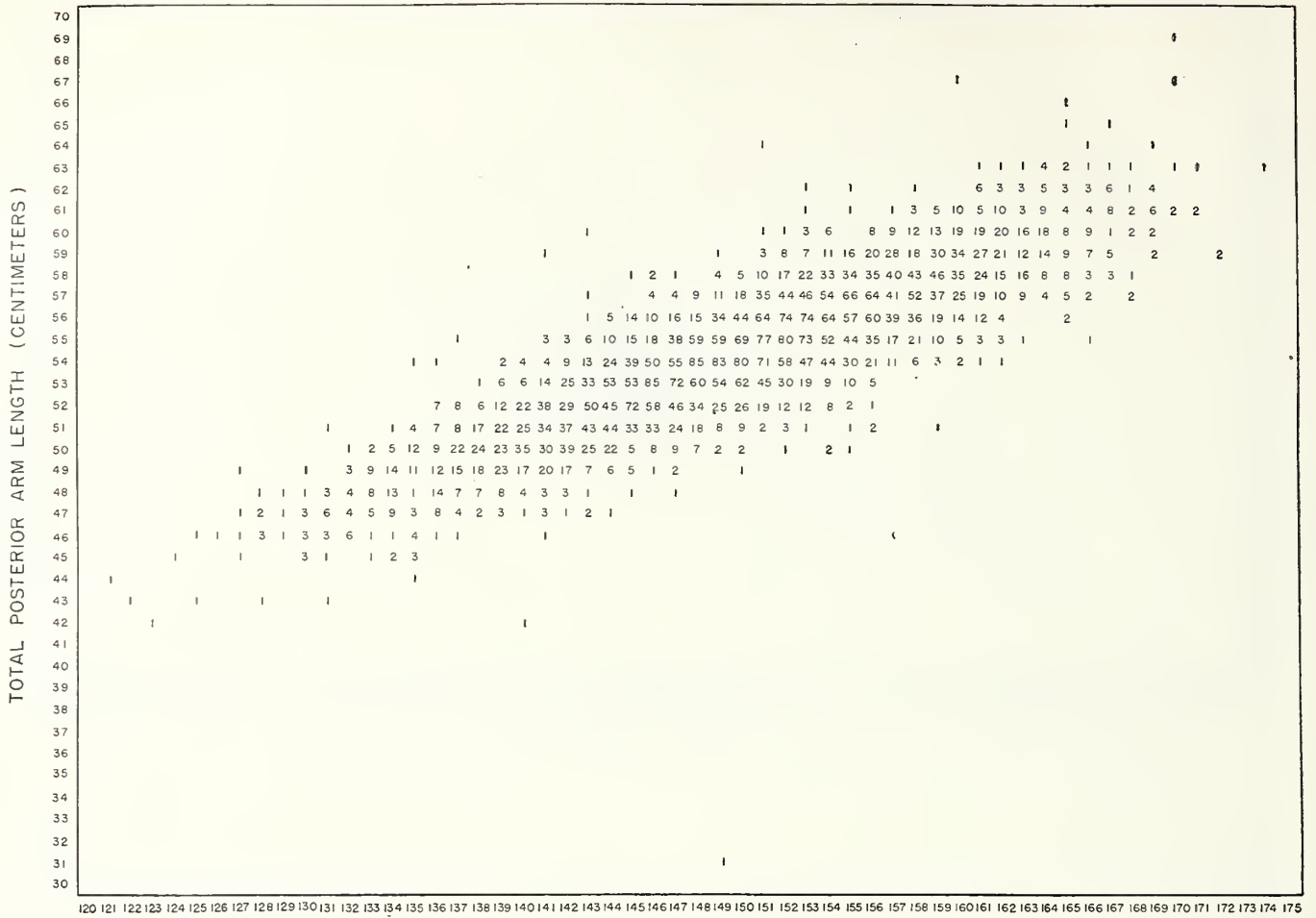


FIGURE 36.—Distribution of 6,174 9-year-old girls on basis of stature and total posterior arm length.



STATURE (CENTIMETERS)

FIGURE 37.—Distribution of 5,866 12-year-old girls on basis of stature and total posterior arm length.

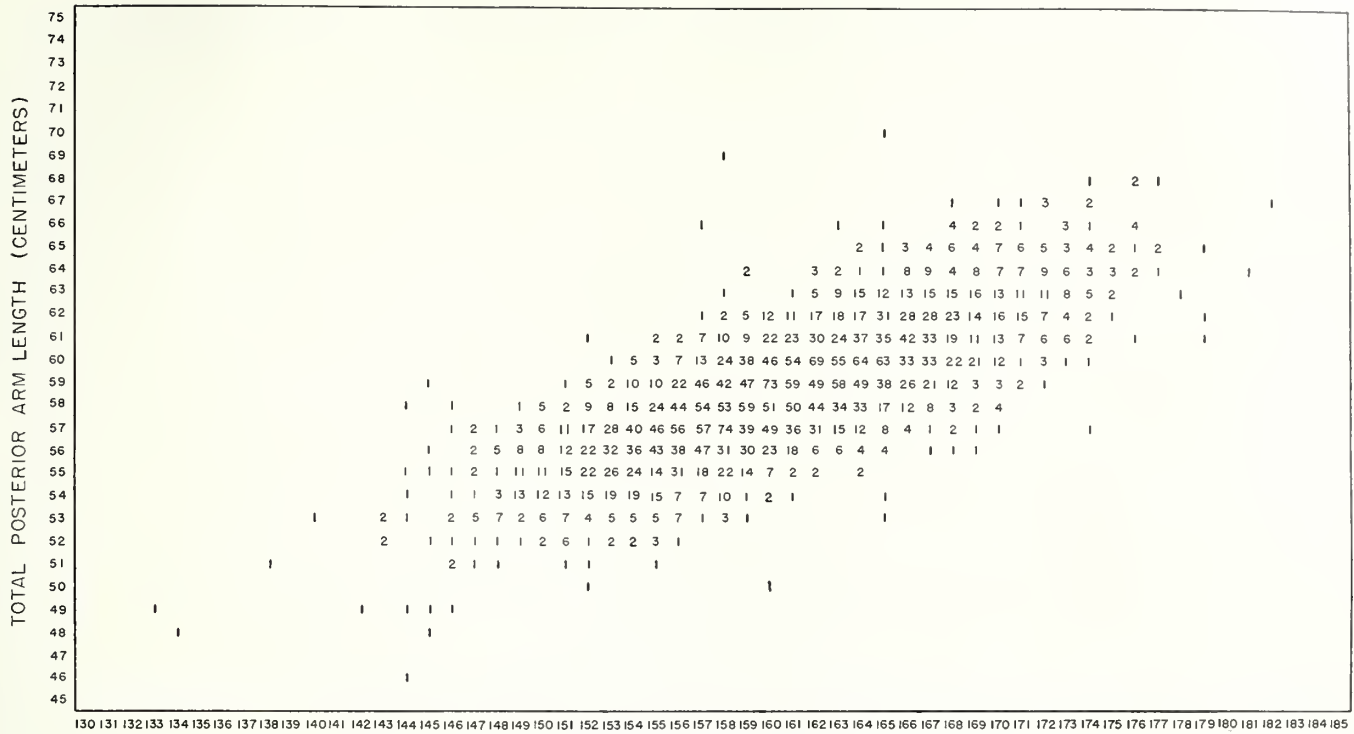


FIGURE 38.—Distribution of 3,991 15-year-old girls on basis of stature and total posterior arm length.

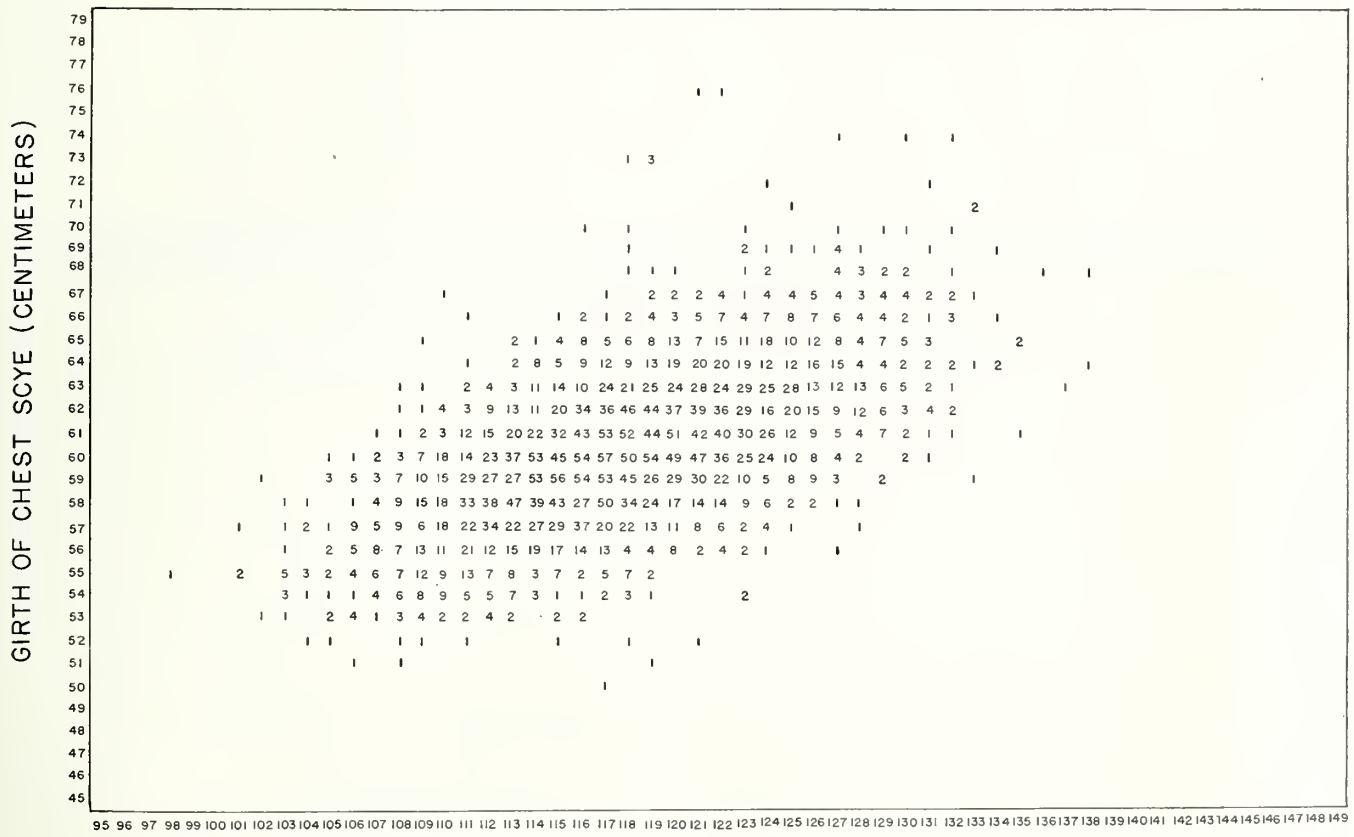
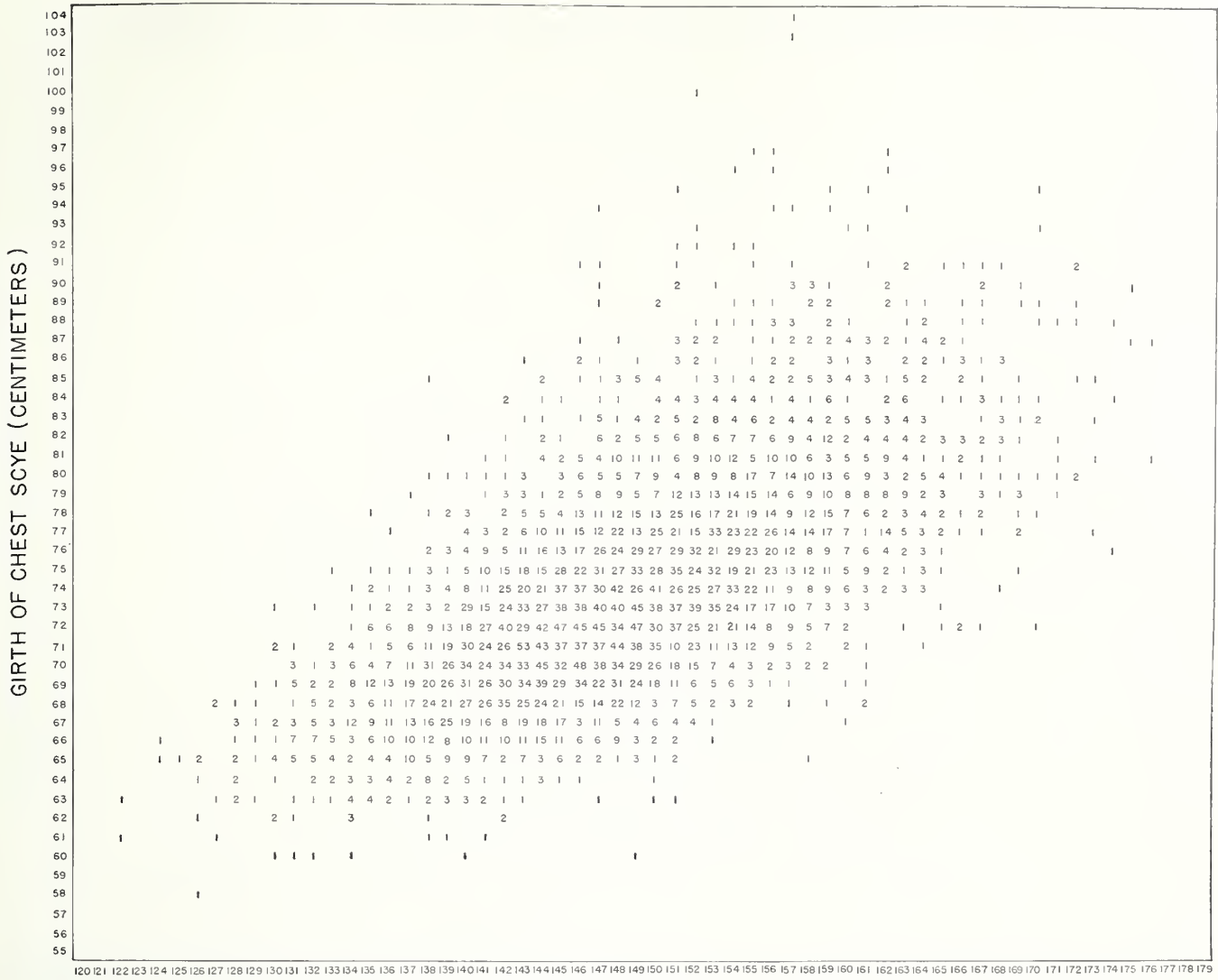


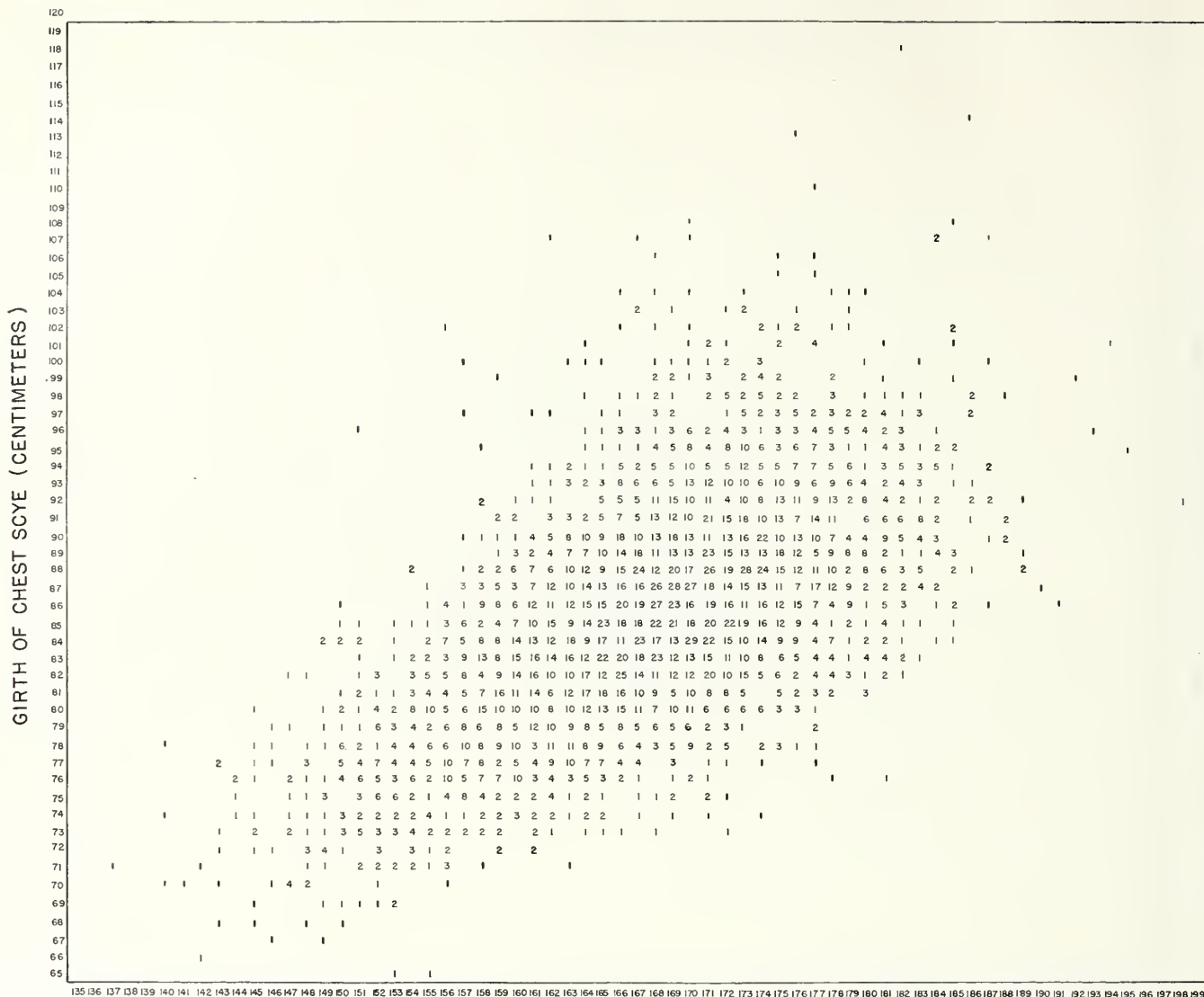
FIGURE 39.—Distribution of 4,157 6-year-old boys on basis of stature and chest girth.





STATURE (CENTIMETERS)

FIGURE 41.—Distribution of 6,612 12-year-old boys on basis of stature and chest girth.



135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199

STATURE (CENTIMETERS)

FIGURE 42.—Distribution of 4,702 15-year-old boys on basis of stature and chest girth.



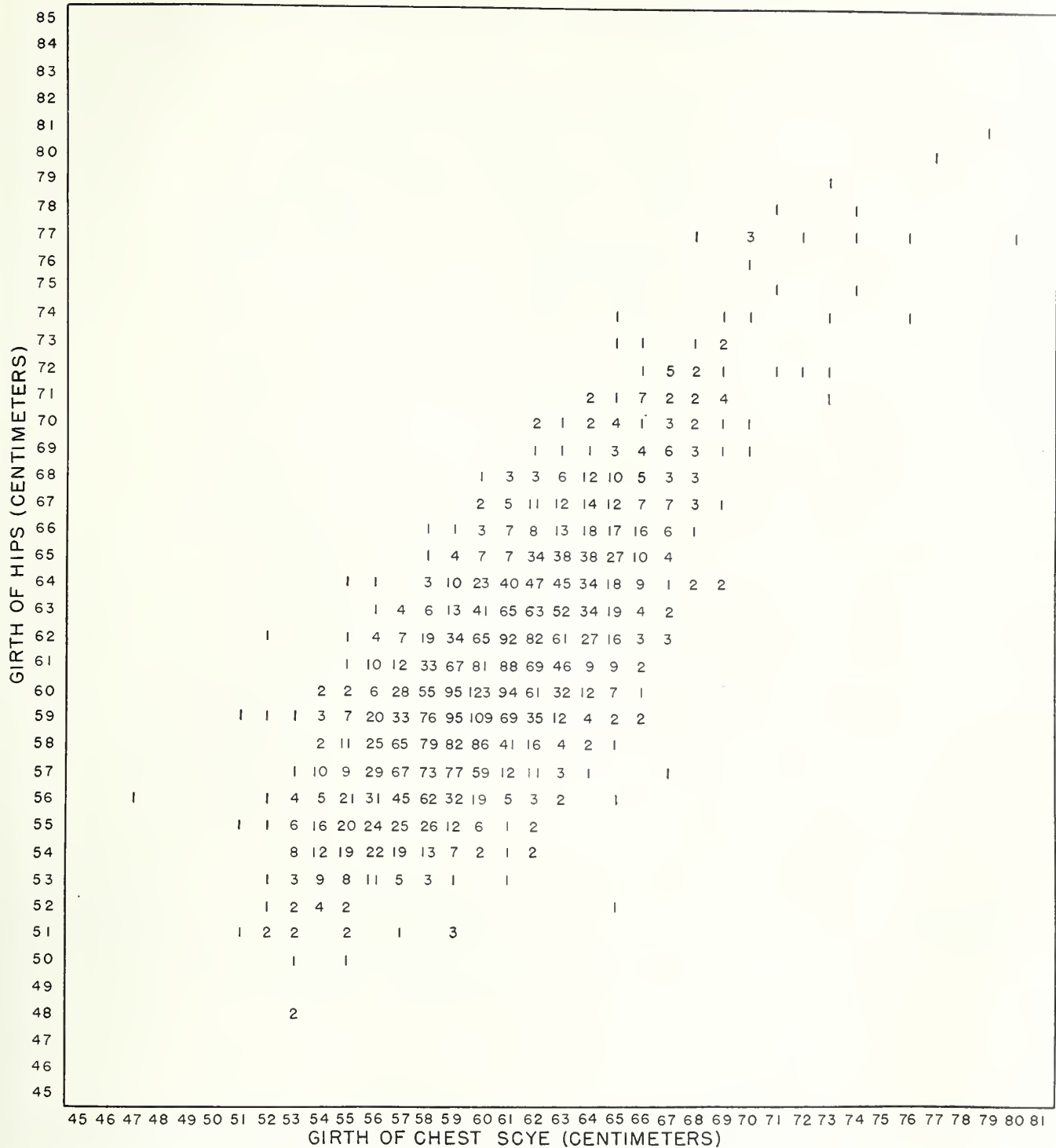
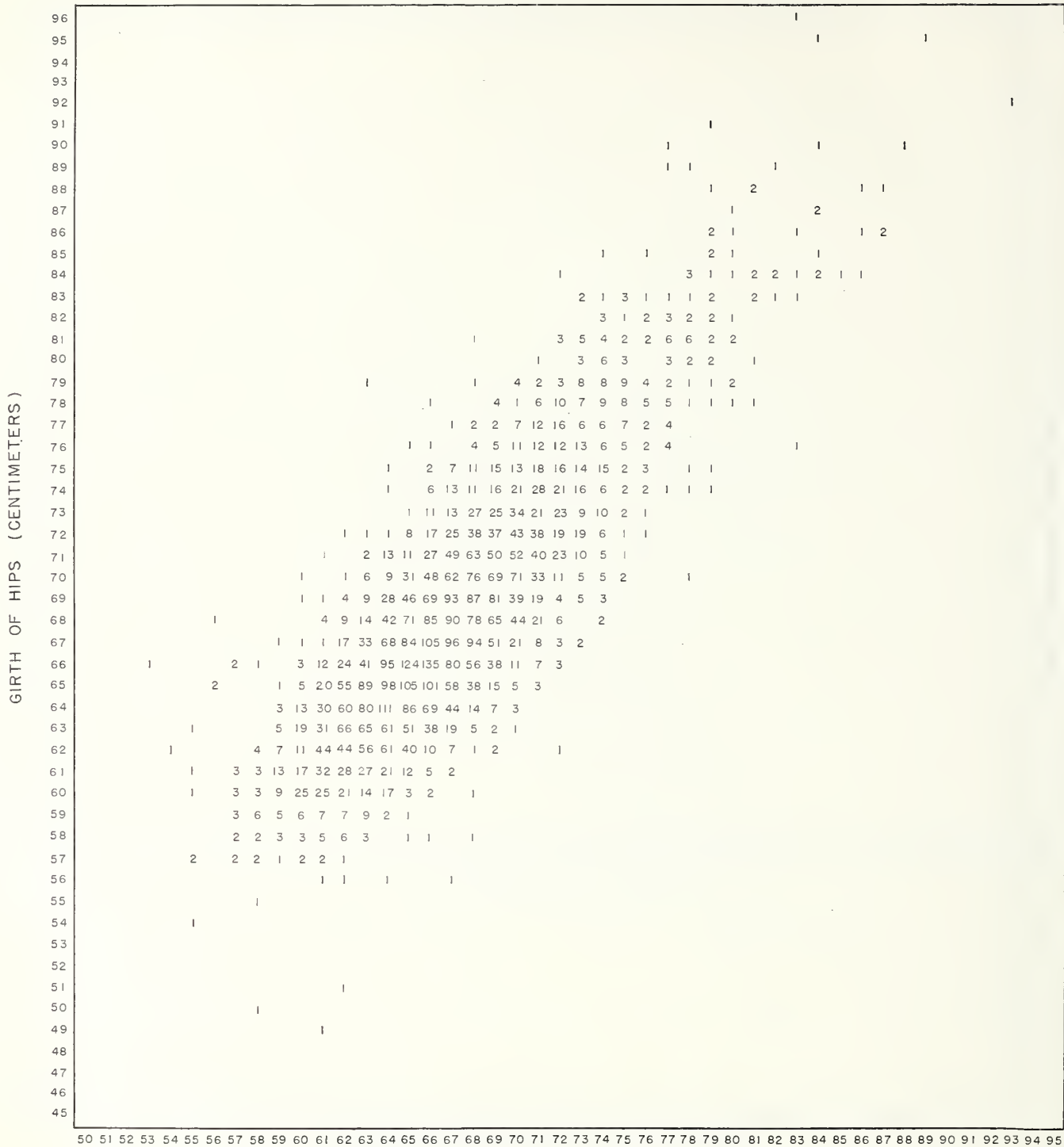


FIGURE 43.—Distribution of 4,157 6-year-old boys on basis of hip girth and chest girth.



GIRTH OF CHEST SCYE ( CENTIMETERS )  
 FIGURE 44.—Distribution of 6,242 9-year-old boys on basis of hip girth and chest girth.

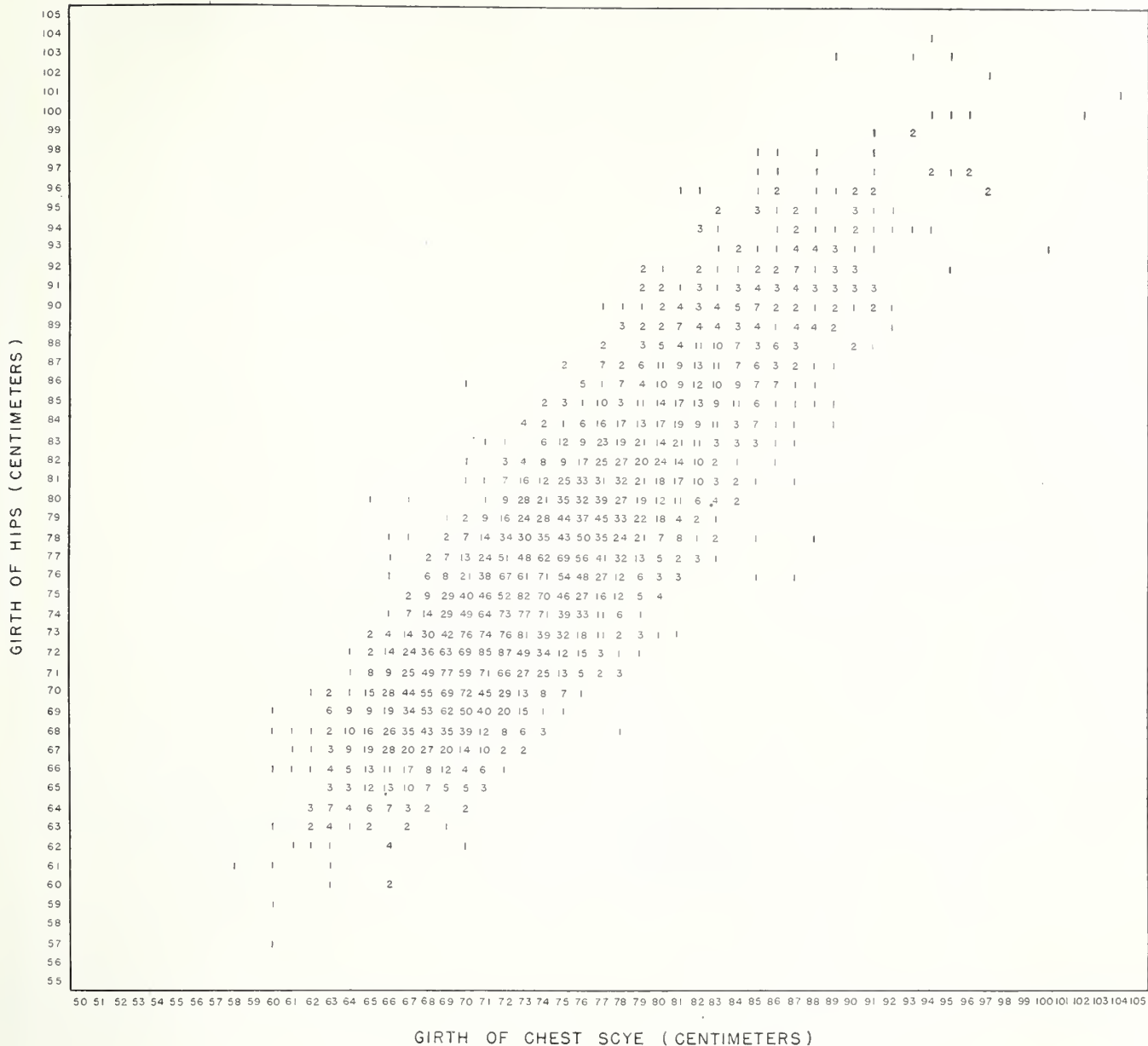
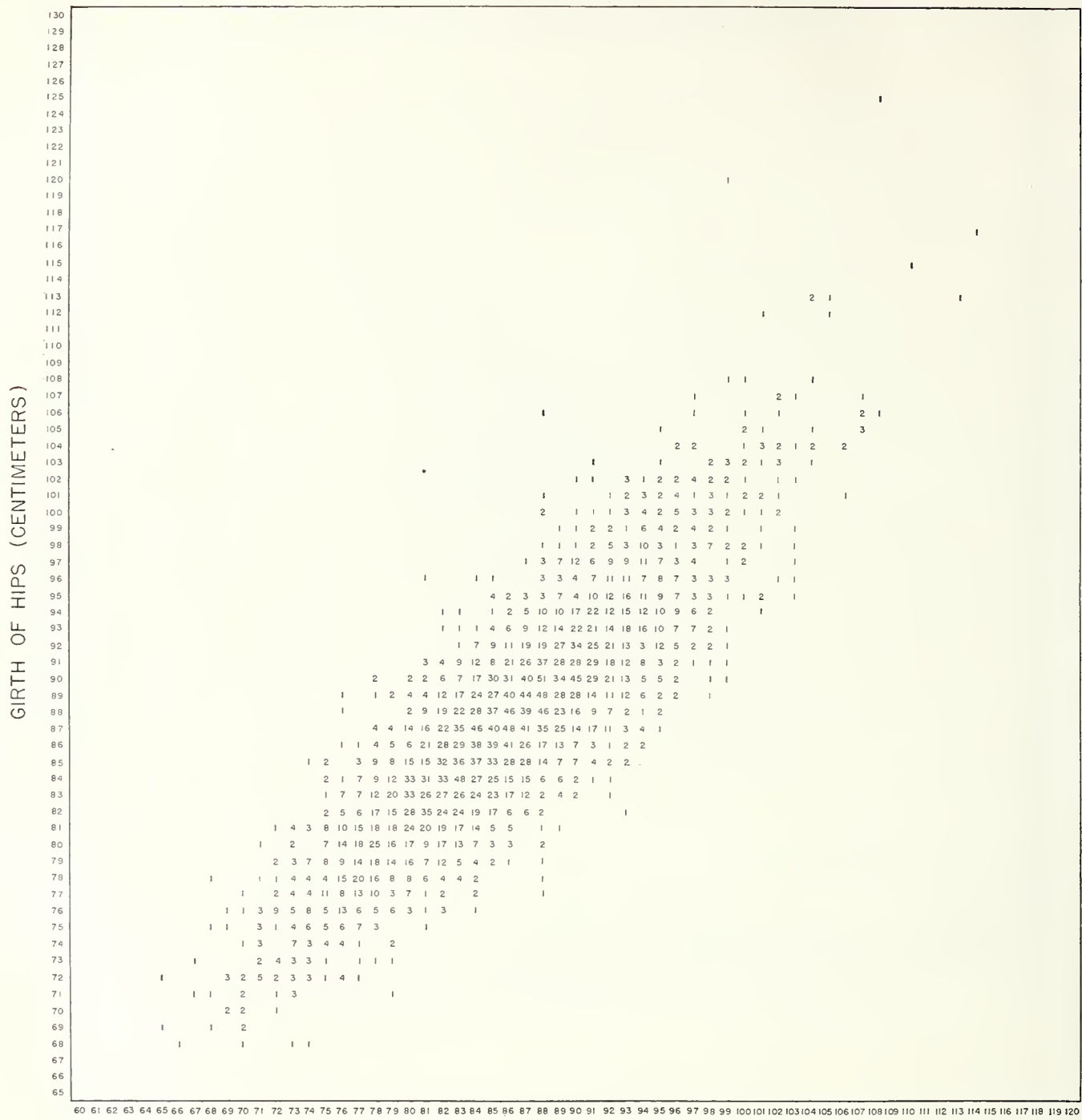


FIGURE 45.—Distribution of 6,612 12-year-old boys on basis of hip girth and chest girth.



GIRTH OF CHEST SCYE (CENTIMETERS)

FIGURE 46.—Distribution of 4,702 15-year-old boys on basis of hip girth and chest girth.

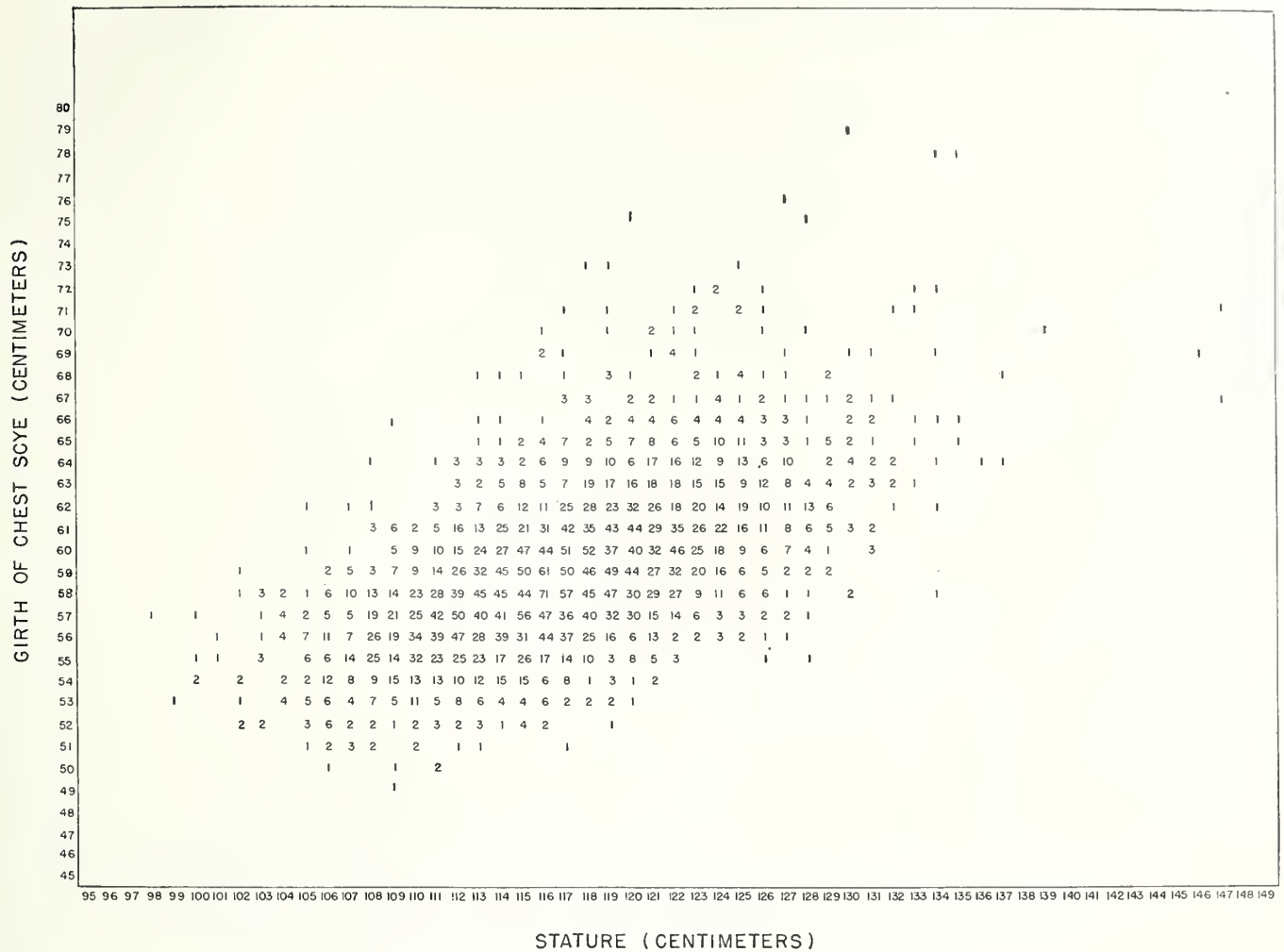


FIGURE 47.—Distribution of 4,559 6-year-old girls on basis of stature and chest girth.



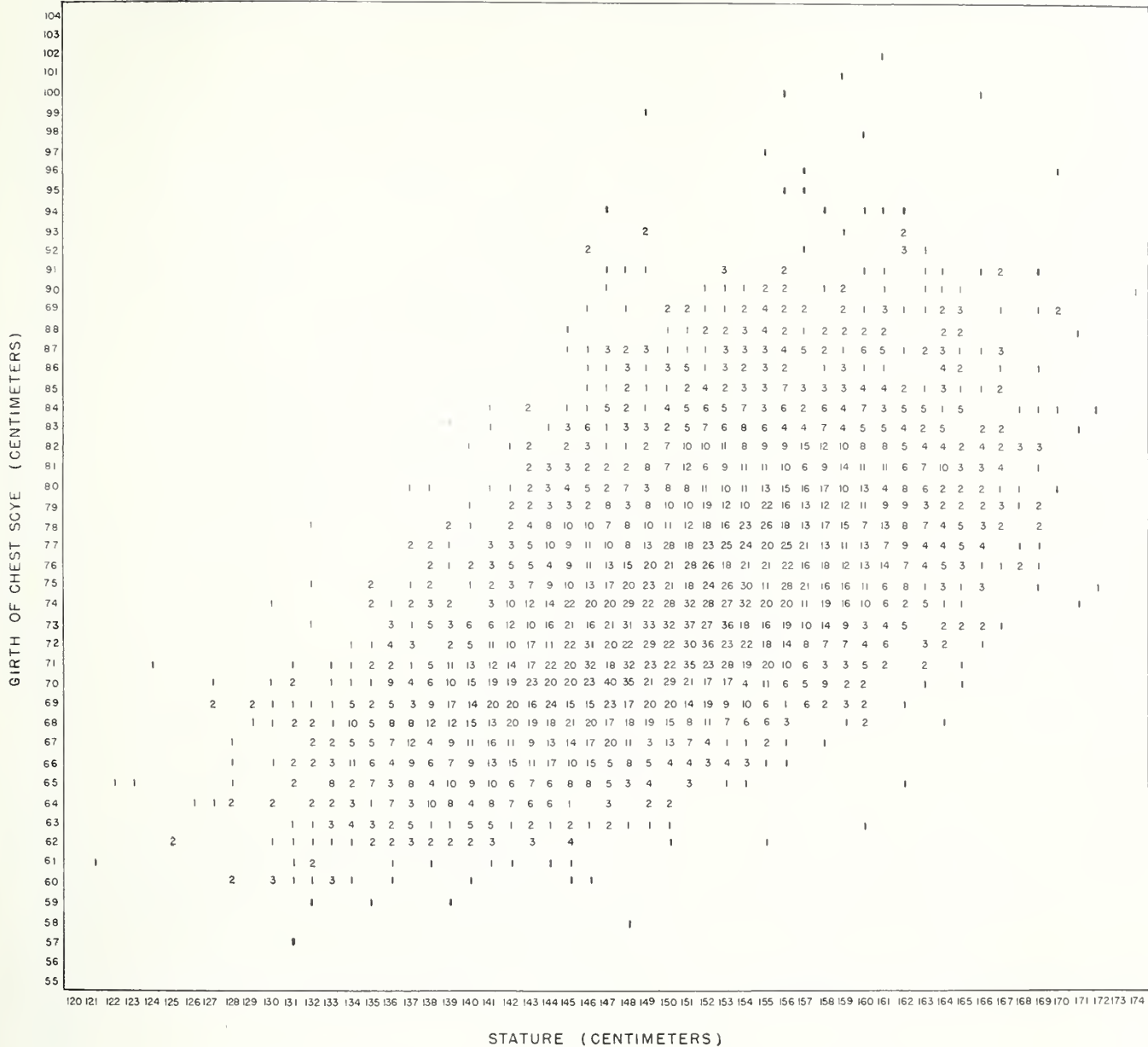


FIGURE 49.—Distribution of 5,866 12-year-old girls on basis of stature and chest girth.

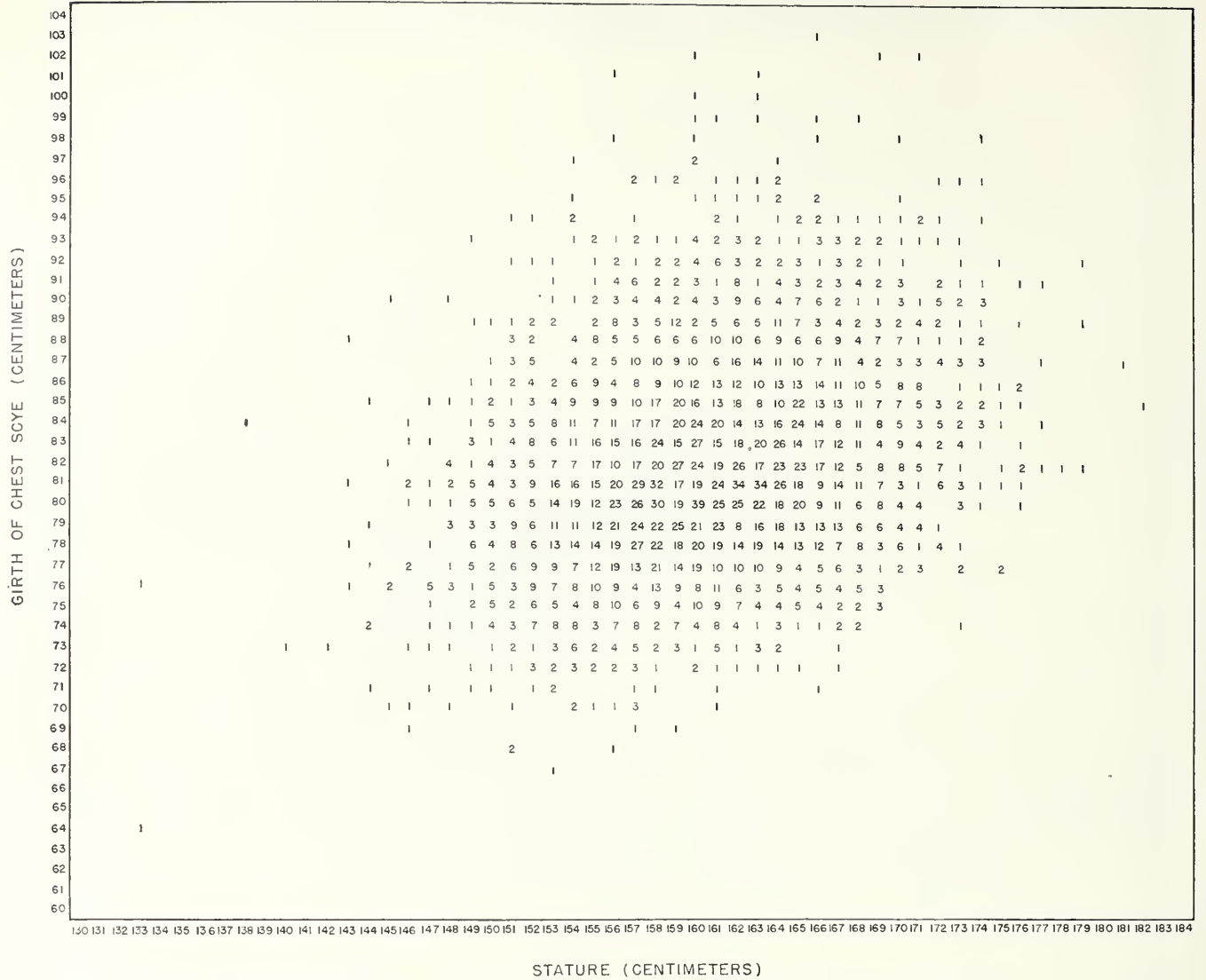


FIGURE 50.—Distribution of 3,991 15-year-old girls on basis of stature and chest girth.







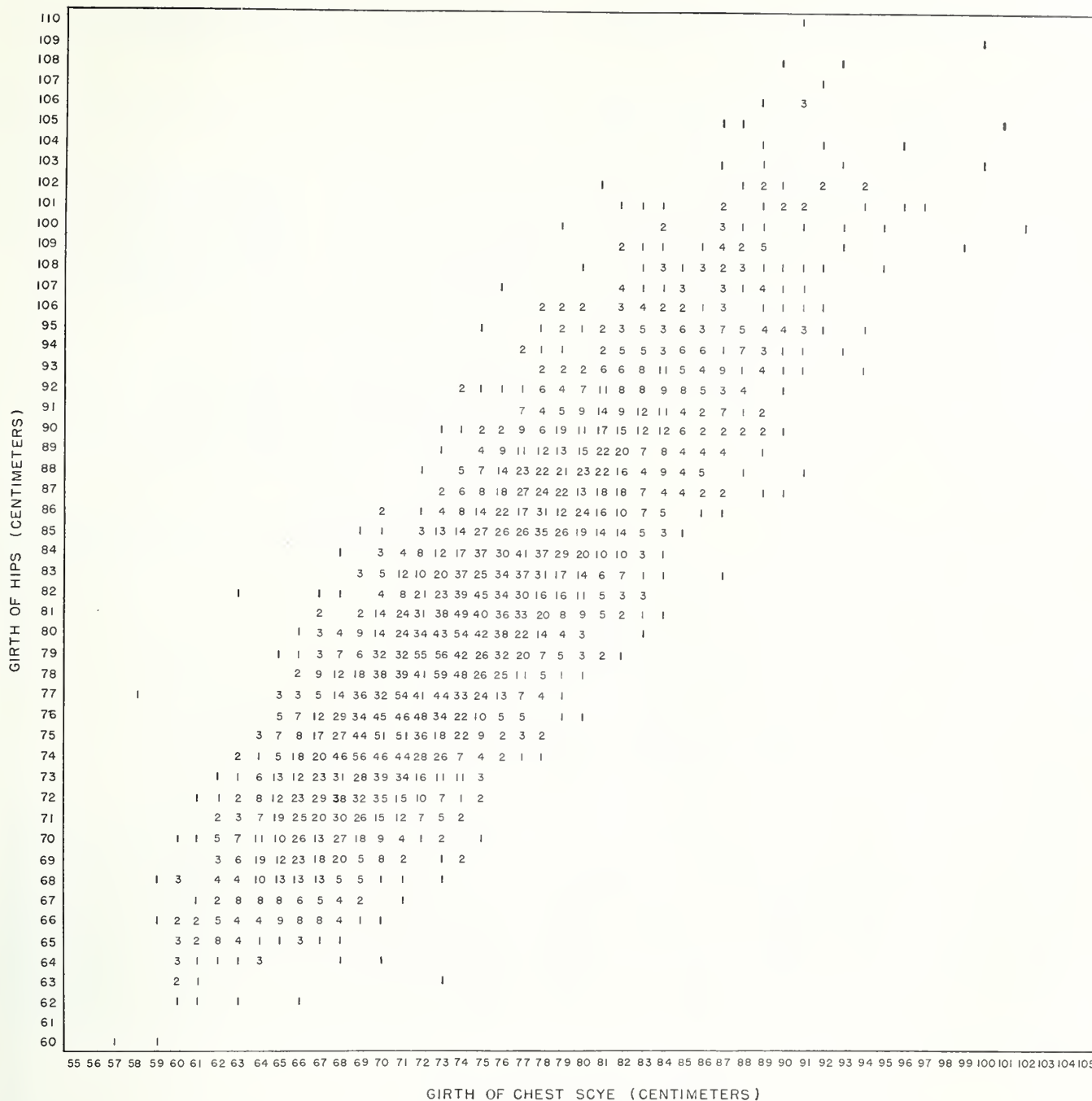


FIGURE 53.—Distribution of 5,866 12-year-old girls on basis of hip girth and chest girth.

Figures 55 and 56<sup>25b</sup> show the bivariate distributions of stature and weight for boys aged 4 to 14 and girls aged 4 to 11. The broken curves shown on these figures represent the average weight for a constant interval of 1 centimeter in height. The smooth curves represent plotted points calculated from the regression equation (see p. 70). As was expected from theoretical considerations, the regression curves lie slightly above the curves drawn through the averages.

<sup>25b</sup> In pocket on back of cover.

In addition to calculating the regressions for combined age ranges as above, regressions were also obtained for the natural logarithm of weight on height for each of the age groups separately (4 to 14 for boys and 4 to 11 for girls). The formulae for these regression equations, the number of cases, the standard error of estimate, and the standard errors of the coefficients are presented in table 38. Tests of significance indicated that all the regression coefficients are significantly different from zero.

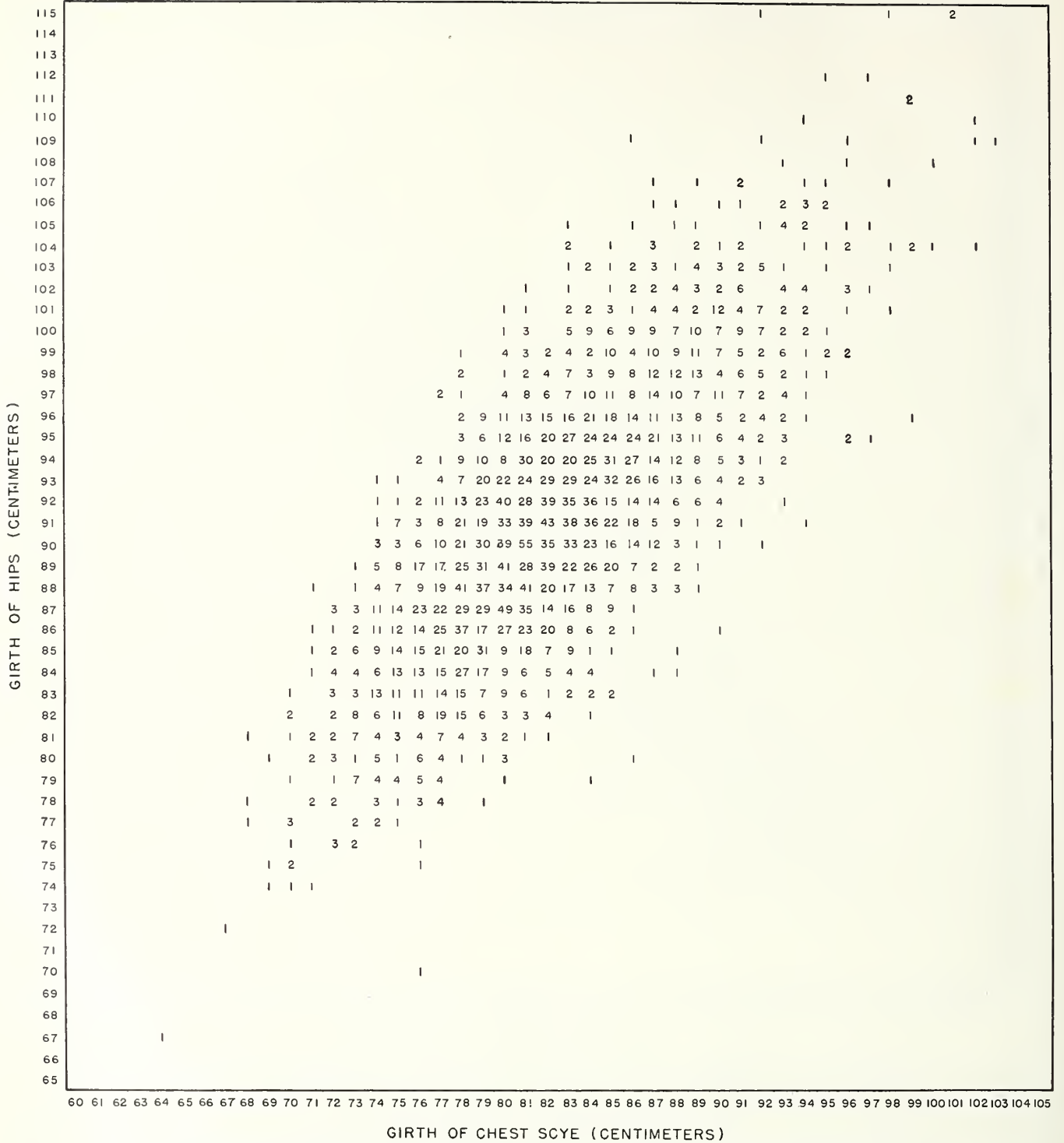


FIGURE 54.—Distribution of 3,991 15-year-old girls on basis of hip girth and chest girth.

TABLE 38.—Regressions of logarithm of weight on stature for boys aged 4 to 14 and girls aged 4 to 11

BOYS					
Age (years)	General formula: $\log_e w = a + b(H - \bar{H})^1$	Standard error of estimate	Standard error of a	Standard error of b	Number of cases <sup>2</sup>
4	$\log_e w = 3.6458 + 0.0180(H - 105.0226)$	0.0754	0.0027	0.0005	798
5	$\log_e w = 3.7565 + 0.0193(H - 111.9030)$	0.0787	0.0017	0.0003	2,134
6	$\log_e w = 3.8578 + 0.0191(H - 117.8057)$	0.0776	0.0012	0.0002	4,082
7	$\log_e w = 3.9554 + 0.0186(H - 123.2802)$	0.0792	0.0011	0.0002	5,010
8	$\log_e w = 4.0552 + 0.0190(H - 128.6872)$	0.0882	0.0012	0.0002	5,760
9	$\log_e w = 4.1536 + 0.0183(H - 133.8324)$	0.0893	0.0011	0.0002	6,099
10	$\log_e w = 4.2422 + 0.0190(H - 138.5239)$	0.0965	0.0012	0.0002	6,488
11	$\log_e w = 4.3289 + 0.0185(H - 143.0184)$	0.1006	0.0013	0.0002	6,346
12	$\log_e w = 4.4264 + 0.0186(H - 148.1872)$	0.1046	0.0013	0.0002	6,458
13	$\log_e w = 4.5388 + 0.0179(H - 154.1382)$	0.1056	0.0013	0.0002	6,114
14	$\log_e w = 4.6558 + 0.0175(H - 160.3205)$	0.1033	0.0015	0.0002	4,661

GIRLS					
Age (years)	General formula: $\log_e w = a + b(H - \bar{H})^1$	Standard error of estimate	Standard error of a	Standard error of b	Number of cases <sup>2</sup>
4	$\log_e w = 3.6156 + 0.0189(H - 104.3897)$	0.0841	0.0027	0.0005	975
5	$\log_e w = 3.7238 + 0.0201(H - 110.8678)$	0.0840	0.0017	0.0003	2,556
6	$\log_e w = 3.8281 + 0.0201(H - 116.8038)$	0.0887	0.0013	0.0002	4,500
7	$\log_e w = 3.9313 + 0.0203(H - 122.2041)$	0.0933	0.0013	0.0002	5,302
8	$\log_e w = 4.0329 + 0.0200(H - 127.7287)$	0.0989	0.0013	0.0002	5,609
9	$\log_e w = 4.1299 + 0.0201(H - 132.6518)$	0.1066	0.0014	0.0003	6,100
10	$\log_e w = 4.2360 + 0.0199(H - 138.2099)$	0.1149	0.0015	0.0002	6,146
11	$\log_e w = 4.3500 + 0.0192(H - 144.1213)$	0.1211	0.0016	0.0002	6,016

<sup>1</sup>  $w$  = weight in pounds,  $H$  = stature in centimeters and  $\bar{H}$  = mean of stature in centimeters.

<sup>2</sup> These regressions were obtained by combining for any given age the basic quantities used in the calculation of the corresponding regressions of socioeconomic groups A and B of table 60.

## Measurements of Children Living in Different Regions of the Country

An analysis of the body measurements of children living in different parts of the country was undertaken. This was done at the request of manufacturers and distributors, whose experience had indicated that possibly there are sufficient regional differences in the body build of children to warrant consideration in distributing clothing and pattern sizes (see p. 51). The basic classifications in the study were age, State, and sex. The statistical quantities analyzed were means, standard deviations, and correlations. The means and standard deviations were calculated for each age, State, and sex for each of 19 measurements. These are given in tables 39 and 40. Correlation coefficients were calculated within each of the classifications for only 7 measurements. These are given in tables 41 to 49, inclusive.

TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14

State	WAIST HEIGHT																										
	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	71.16	3.51	283	75.21	3.79	436	78.91	4.22	483	82.40	4.22	495	86.43	4.57	548	89.74	4.84	510	93.41	5.13	533	97.39	5.70	458	101.76	5.96	410
California	72.37	4.07	237	76.69	4.14	234	81.00	4.53	264	84.99	4.55	296	88.76	5.32	274	92.85	4.80	283	96.03	5.43	278	99.84	5.19	284	103.52	5.19	277
Colorado	71.16	3.89	263	74.72	4.42	298	79.27	4.54	362	83.36	4.56	366	86.97	4.94	399	90.42	4.81	372	94.49	5.23	414	98.54	5.31	328	101.80	5.85	294
District of Columbia, Maryland, and Virginia	72.52	4.22	430	76.25	4.51	502	80.55	4.82	535	83.98	5.15	608	87.67	5.18	604	90.94	5.23	582	95.62	5.84	917	99.42	5.84	1,117	103.22	5.70	894
Illinois	72.84	4.09	165	76.96	4.55	270	80.08	4.72	348	83.54	4.83	353	87.15	5.08	397	90.67	5.31	409	94.46	5.57	411	97.88	5.99	406	101.48	5.77	282
Iowa	71.05	3.81	417	75.10	3.78	429	79.56	4.06	544	83.57	4.54	483	86.96	5.24	554	90.82	5.11	501	93.81	5.55	321	97.88	5.57	229	102.42	5.61	168
Kansas	71.46	4.00	220	75.35	3.34	320	80.20	4.57	346	83.33	4.54	332	87.35	5.15	359	91.25	5.10	354	95.08	5.36	518	98.56	5.55	512	101.84	5.60	398
Michigan	71.73	4.00	176	75.51	3.87	248	79.43	4.65	345	83.24	4.41	360	87.11	4.84	465	90.37	4.98	409	92.97	5.07	419	97.14	5.56	278	101.40	5.93	225
Minnesota	71.83	4.11	563	75.91	4.02	559	80.26	4.59	577	84.25	5.02	687	87.48	5.05	617	91.09	5.08	629	94.72	5.86	542	99.03	6.18	601	103.11	5.96	473
Nebraska	72.06	4.33	203	76.08	4.31	221	79.99	4.59	225	84.23	4.88	232	87.77	4.97	247	90.01	5.58	202	93.15	5.18	162	97.81	5.68	134	101.31	5.14	52
Ohio	70.94	4.08	294	74.82	4.18	392	78.52	4.76	488	82.69	5.01	576	86.42	4.85	581	89.53	5.28	606	93.25	5.26	558	97.54	5.68	519	100.73	5.90	356
Pennsylvania	71.74	3.91	253	75.25	4.43	290	79.01	4.75	299	83.38	4.97	316	86.07	5.05	345	90.34	5.44	336	94.13	5.74	413	97.98	6.34	461	102.10	6.25	429
Tennessee	70.77	4.25	162	75.08	4.50	220	79.10	4.72	354	82.71	4.58	343	86.32	4.46	381	89.12	4.93	404	93.26	5.10	336	97.04	5.69	344	101.91	5.63	195
Texas	71.94	3.54	330	75.79	4.04	450	79.54	4.27	415	83.59	4.22	431	87.60	4.46	434	90.93	4.75	480	94.99	5.00	443	98.34	5.07	368	101.60	5.69	213
Utah	72.16	4.37	161	76.37	4.01	245	80.17	4.36	308	84.12	4.85	364	87.56	4.79	441	90.55	5.29	411	93.64	4.84	347	97.46	5.13	216	101.07	5.60	111

State	HIP HEIGHT																										
	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	57.21	3.02	283	60.67	3.30	436	63.71	3.65	483	66.84	3.62	495	70.22	3.95	548	73.09	4.17	510	76.29	4.47	533	79.79	4.93	458	83.17	5.08	410
California	57.73	3.43	237	61.51	3.56	234	65.24	3.94	264	68.66	3.92	296	71.88	4.52	274	75.37	4.32	283	78.30	4.84	278	82.05	4.96	284	85.51	4.78	277
Colorado	57.14	3.30	263	60.07	3.64	298	64.00	3.85	362	67.34	3.95	366	70.55	4.18	399	73.44	4.19	372	77.13	4.56	414	80.66	4.67	328	83.27	5.00	294
District of Columbia, Maryland, and Virginia	57.97	3.53	430	61.17	3.90	502	64.82	4.15	535	67.85	4.57	608	71.03	4.55	604	73.92	4.67	582	78.11	5.06	917	81.19	4.95	1,117	84.18	4.86	894
Illinois	58.55	3.51	165	62.11	3.74	270	64.76	4.09	348	67.61	4.06	353	70.81	4.35	397	73.69	4.56	409	77.05	4.92	411	80.11	5.17	406	83.16	5.15	282
Iowa	56.67	3.23	417	60.14	3.17	429	63.85	3.48	544	67.30	3.80	483	70.10	4.44	554	73.42	4.41	501	75.99	4.60	321	79.21	4.69	229	83.39	4.61	168
Kansas	57.05	3.31	220	60.53	3.72	320	64.55	3.73	346	67.23	3.85	332	70.79	4.36	359	74.01	4.44	354	77.32	4.55	518	80.36	4.86	512	83.44	4.91	398
Michigan	57.57	3.28	176	61.04	3.32	248	64.37	3.93	345	67.58	3.80	360	70.83	4.09	465	73.56	4.26	409	75.91	4.42	419	79.35	4.69	278	82.82	5.07	225
Minnesota	57.19	3.44	563	60.68	3.44	559	64.36	3.96	577	67.91	4.31	687	70.87	4.24	617	73.88	4.32	629	77.02	5.06	542	80.73	5.42	601	83.98	5.05	473
Nebraska	57.35	3.74	203	60.85	3.64	221	64.20	3.77	225	67.75	4.03	232	70.74	4.18	247	72.79	4.74	202	75.51	4.47	162	79.40	4.94	134	81.83	4.14	52
Ohio	56.94	3.50	294	60.26	3.61	392	63.50	3.97	488	67.14	4.24	576	70.25	4.18	581	72.91	4.49	606	76.37	4.65	558	79.98	4.95	519	82.56	5.01	356
Pennsylvania	57.32	3.41	253	60.33	3.86	290	63.51	4.19	299	67.25	4.32	316	69.62	4.27	345	73.48	4.57	336	76.63	4.91	413	79.84	5.26	461	83.11	5.04	429
Tennessee	56.44	3.79	162	60.14	3.97	220	63.02	4.03	354	66.56	3.98	343	69.70	3.87	381	72.16	4.31	404	75.75	4.44	336	79.25	4.99	344	83.28	4.85	195
Texas	58.27	2.98	330	61.41	3.48	450	64.74	3.72	415	68.26	3.57	431	71.62	3.70	434	74.50	4.02	480	77.92	4.25	443	80.88	4.33	368	83.87	4.77	213
Utah	58.17	3.63	161	61.95	3.46	245	65.00	3.70	308	68.42	4.17	364	71.32	4.11	441	73.90	4.47	411	76.52	4.22	347	79.88	4.75	216	82.50	5.10	111

TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14—Continued

WEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	46.93	5.28	283	51.44	6.21	436	56.05	7.43	483	61.24	7.85	495	67.87	9.99	548	73.38	11.83	510	80.30	14.48	533	88.88	15.48	458	101.70	19.72	410
California	50.11	5.95	237	55.39	6.88	234	62.05	9.35	264	68.75	9.27	296	76.72	13.75	274	84.08	14.38	283	92.34	15.74	278	104.06	18.87	284	117.04	19.90	277
Colorado	46.19	5.40	263	50.14	6.77	298	56.40	7.88	362	62.88	9.35	366	68.28	10.41	379	74.78	11.32	372	82.82	14.72	414	93.04	15.76	328	101.93	17.53	294
District of Columbia, Maryland, and Virginia	48.63	6.67	430	53.36	7.58	502	59.40	9.04	535	65.26	10.21	608	71.12	11.72	604	77.30	12.66	582	88.31	16.99	917	97.94	18.46	1,117	109.96	19.97	894
Illinois	50.32	7.56	165	55.02	7.84	270	59.99	9.91	348	65.16	9.49	353	71.56	11.86	397	78.74	14.27	409	86.20	16.15	411	95.99	17.99	406	107.63	19.96	282
Iowa	47.17	6.16	417	52.02	6.59	429	58.58	9.04	544	64.59	9.55	483	70.56	11.58	554	78.44	13.75	501	83.82	15.50	321	95.48	18.11	229	107.10	20.97	168
Kansas	47.35	5.69	220	52.00	7.22	320	58.98	8.80	346	63.95	9.64	332	70.35	10.67	359	76.64	12.41	354	87.30	15.68	518	96.54	16.47	512	107.02	19.07	398
Michigan	48.66	6.81	176	53.45	6.58	248	59.39	8.80	345	64.51	8.81	360	71.02	11.07	465	78.08	13.35	409	82.69	13.22	419	92.95	17.32	278	107.55	19.17	225
Minnesota	47.44	6.39	563	52.60	6.76	559	58.79	8.38	577	65.29	10.07	687	70.79	11.49	617	77.78	13.10	629	86.01	15.60	542	96.57	18.48	601	109.03	19.79	473
Nebraska	47.67	6.32	203	53.08	7.15	221	58.08	8.67	225	64.18	10.03	232	71.10	10.82	247	75.13	11.99	202	80.55	12.79	162	93.04	17.48	134	102.52	16.24	52
Ohio	47.29	6.73	294	52.15	6.99	392	56.98	8.46	488	63.59	9.83	576	69.65	10.96	581	75.51	12.22	606	83.17	15.91	558	93.69	17.32	519	102.55	18.92	356
Pennsylvania	47.51	6.02	253	52.27	6.73	290	58.29	8.46	299	64.71	11.02	316	69.91	12.36	345	78.33	13.62	336	85.86	15.65	413	96.15	18.82	461	108.29	21.02	429
Tennessee	45.65	5.94	162	51.50	7.35	220	56.61	8.97	354	61.51	9.05	343	67.12	10.50	381	72.39	11.04	404	80.49	14.10	336	90.53	16.93	344	103.53	18.49	195
Texas	48.59	6.92	330	53.65	7.89	434	58.46	8.02	415	65.22	10.07	431	72.25	11.77	434	78.68	12.90	480	86.53	14.69	443	94.53	17.31	368	104.17	17.82	213
Utah	47.88	5.89	161	52.32	6.59	245	57.37	7.90	308	63.96	8.76	364	69.63	11.44	441	74.96	11.48	411	81.14	12.39	347	89.93	14.83	216	99.27	17.21	111

STATURE

Alabama	117.24	4.90	283	122.83	5.16	436	127.70	5.75	483	132.42	5.64	495	137.62	6.01	548	142.05	6.55	510	147.05	7.11	533	152.62	8.15	458	159.40	8.10	410
California	119.11	5.74	237	124.99	5.71	234	130.66	5.91	264	135.90	5.92	296	140.80	7.13	274	146.07	6.24	283	150.69	7.48	278	157.43	8.28	284	163.85	8.14	277
Colorado	117.44	5.37	263	122.20	6.06	298	128.25	6.03	362	133.65	5.91	366	138.42	6.34	399	143.07	6.34	372	148.44	7.26	414	154.50	7.56	328	159.65	8.52	294
District of Columbia, Maryland, and Virginia	118.37	5.57	430	123.53	5.98	502	129.19	6.52	535	133.84	6.85	608	138.48	6.64	604	143.01	7.02	582	149.37	7.83	917	155.08	8.49	1,117	161.30	8.41	894
Illinois	119.77	5.43	165	125.30	5.88	270	129.47	6.27	348	133.80	6.41	353	138.88	6.92	397	143.38	7.24	409	148.64	7.65	411	154.05	8.65	406	159.98	8.64	282
Iowa	116.80	5.34	417	122.46	5.04	429	128.36	5.56	544	133.65	5.94	483	137.99	6.94	554	143.10	6.71	501	147.13	7.72	321	153.12	8.16	229	160.30	8.49	168
Kansas	117.53	5.39	220	122.94	5.78	320	129.37	5.96	346	133.54	5.99	332	138.81	6.57	359	143.10	6.99	354	149.34	7.49	518	154.81	8.08	512	160.34	8.61	398
Michigan	117.85	5.39	176	123.24	5.12	248	128.59	6.01	345	133.61	5.70	360	138.47	6.41	465	142.91	6.75	409	146.47	6.88	419	152.40	8.15	278	159.68	8.96	225
Minnesota	117.41	5.53	563	122.83	5.37	559	128.75	6.11	577	134.26	6.54	687	138.50	6.40	617	143.33	6.63	629	148.41	7.97	542	154.56	8.69	601	160.77	8.73	473
Nebraska	118.53	5.91	203	124.00	5.79	221	129.11	5.99	225	134.76	6.47	232	139.31	6.35	247	142.30	7.11	202	146.46	7.07	162	153.57	8.30	134	159.17	7.76	52
Ohio	117.51	5.47	294	122.92	5.60	392	127.99	6.22	488	133.41	6.52	576	138.20	6.38	581	142.30	6.79	606	147.47	7.18	558	153.71	8.11	519	158.60	8.73	356
Pennsylvania	117.34	5.27	253	122.51	5.86	290	127.70	6.09	299	133.39	6.49	316	137.08	6.46	345	142.65	6.82	336	147.71	7.59	413	153.46	9.02	461	159.89	9.22	429
Tennessee	116.41	5.76	162	122.59	5.92	220	127.94	6.23	354	132.78	6.07	343	137.49	6.22	381	141.41	6.57	404	146.82	7.04	336	152.31	8.31	344	159.89	8.37	195
Texas	118.54	4.91	330	123.75	5.33	434	128.74	5.70	415	134.16	5.44	431	139.41	5.75	434	143.74	6.20	480	148.91	6.70	443	154.18	7.42	368	159.31	8.56	213
Utah	118.58	5.87	161	124.07	5.52	245	129.32	5.88	308	134.59	6.21	364	138.93	6.48	441	142.83	6.89	411	147.15	6.47	347	152.75	7.41	216	157.54	8.23	111

CERVICALE HEIGHT

Alabama	97.08	4.35	283	101.96	4.68	436	106.52	5.19	483	110.86	5.20	495	115.65	5.59	548	119.95	6.23	510	124.71	6.71	533	129.90	7.63	458	136.07	8.05	410
California	98.60	5.00	237	104.04	5.06	234	109.08	5.56	264	114.18	5.58	296	118.67	6.60	274	123.75	5.84	283	127.74	6.90	278	133.60	7.55	284	139.35	7.48	277
Colorado	97.24	4.81	263	101.61	5.43	298	107.14	5.60	362	112.03	5.54	366	116.57	5.97	399	120.98	5.90	372	126.08	6.80	414	131.67	6.93	328	136.43	7.90	294
District of Columbia, Maryland, and Virginia	98.14	5.02	430	102.73	5.54	502	107.98	5.94	535	112.13	6.34	608	116.68	6.25	604	120.91	6.60	582	126.83	7.44	917	132.02	7.86	1,117	137.68	7.83	894
Illinois	99.00	4.71	165	104.18	5.32	270	107.98	5.76	348	111.96	5.90	353	116.65	6.30	397	121.03	6.70	409	126.02	7.24	411	130.94	8.11	406	136.37	8.17	282
Iowa	96.71	4.73	417	101.85	4.62	429	107.17	5.04	544	112.10	5.53	483	116.15	6.42	554	120.93	6.25	501	124.92	7.15	321	130.35	7.39	229	136.89	7.78	168
Kansas	97.20	4.65	220	102.02	5.24	320	107.76	5.34	346	111.67	5.60	332	116.89	6.26	359	121.58	6.50	354	126.65	6.97	518	131.79	7.38	512	136.39	7.84	398
Michigan	97.50	4.86	176	102.29	4.78	248	107.29	5.64	345	112.08	5.36	360	116.83	6.04	465	120.92	6.23	409	124.21	6.46	419	129.84	7.42	278	136.35	8.26	225
Minnesota	97.18	5.08	563	102.07	4.84	559	107.41	5.49	577	112.36	6.03	687	116.48	6.01	617	120.99	6.22	629	125.77	7.55	542	131.63	8.27	601	137.38	7.97	473
Nebraska	97.74	5.48	203	102.81	5.34	221	107.50	5.48	225	112.72	6.09	232	117.09	6.13	247	119.95	6.80	202	124.09	6.53	162	130.49	7.51	134	135.65	6.91	52
Ohio	96.99	4.95	294	101.79	4.89	392	106.36	5.76	488	111.39	6.03	576	115.92	5.99	581	119.80	6.34	606	124.58	6.70	558	130.29	7.45	519	134.90	8.01	356
Pennsylvania	97.10	4.78	253	101.84	5.40	290	106.30	5.46	299	111.67	6.02	316	115.11	6.08	345	120.22	6.36	336	125.17	7.07	413	130.65	8.29	461	136.37	8.49	429
Tennessee	96.30	5.04	162	101.62	5.26	220	106.48	5.73	354	110.79	5.64	343	115.25	5.79	381	118.82	6.18	404	124.01	6.52	336	128.99	7.64	344	136.01	7.74	195
Texas	98.21	4.43	330	102.70	4.82	434	107.25	5.21	415	112.21	5.19	431	117.23	5.51	434	121.28	5.86	480	126.31	6.31	443	131.02	6.78	368	135.75	7.84	213
Utah	98.35	5.18	161	103.23	4.84	245	107.95	5.23	308	112.75	5.78	364	116.95	6.03													

TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14—Continued

BITROCHANTERIC DIAMETER

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	21.24	1.08	283	21.96	1.39	436	22.73	1.36	483	23.58	1.41	495	24.56	1.65	548	25.40	1.77	510	26.31	1.93	533	27.42	2.10	458	28.94	2.40	410
California	21.62	1.16	237	22.41	1.22	234	23.56	1.61	264	24.50	1.52	296	25.46	1.95	274	26.58	1.91	283	27.64	2.07	278	28.91	2.35	284	30.46	2.26	277
Colorado	21.14	1.12	263	21.77	1.27	298	22.80	1.42	362	23.74	1.53	366	24.57	1.68	399	25.56	1.76	372	26.57	2.07	414	27.82	2.09	328	28.85	2.10	294
District of Columbia, Maryland, and Virginia	21.52	1.29	430	22.22	1.39	502	23.27	1.61	535	24.14	1.66	608	24.98	1.77	604	25.89	1.85	582	27.39	2.36	917	28.53	2.28	1,117	29.97	2.38	894
Illinois	21.90	1.49	165	22.66	1.52	270	23.40	1.71	348	24.22	1.71	353	25.17	1.87	397	26.22	2.03	409	27.15	2.10	411	28.38	2.16	406	29.80	2.42	282
Iowa	21.30	1.21	417	22.15	1.24	429	23.16	1.51	544	24.01	1.59	483	24.92	1.82	554	26.11	1.95	501	26.85	2.14	321	28.20	2.19	229	29.68	2.52	168
Kansas	21.12	1.20	220	21.94	1.43	320	23.05	1.47	346	23.76	1.56	332	24.79	1.65	359	25.66	1.74	354	27.15	2.15	518	28.09	2.05	512	29.40	2.28	398
Michigan	21.36	1.34	176	22.20	1.28	248	23.20	1.55	345	23.94	1.50	360	24.95	1.70	465	26.00	1.94	409	26.56	1.77	419	27.94	2.17	278	29.63	2.34	225
Minnesota	21.10	1.25	563	21.96	1.34	559	22.99	1.50	577	23.98	1.64	687	24.85	1.74	617	25.86	1.86	629	26.99	2.10	542	28.31	2.29	601	29.85	2.35	473
Nebraska	21.35	1.38	203	22.29	1.37	221	23.09	1.49	225	24.15	1.70	232	25.09	1.67	247	25.72	1.85	202	26.44	1.89	162	27.81	2.00	134	29.27	2.07	52
Ohio	21.21	1.38	294	22.01	1.31	392	22.78	1.47	488	23.77	2.63	576	24.66	1.71	581	25.54	1.83	606	26.55	1.95	558	27.82	2.15	519	28.99	2.29	356
Pennsylvania	21.11	1.28	253	21.99	1.38	290	22.92	1.48	299	23.95	1.69	316	24.78	1.92	345	25.87	1.98	336	27.03	2.11	413	28.31	2.41	461	29.75	2.61	429
Tennessee	20.91	1.26	162	21.95	1.44	220	22.84	1.63	354	23.60	1.59	343	24.47	1.70	381	25.19	1.61	404	26.36	1.93	336	27.54	2.22	344	29.07	2.11	195
Texas	21.40	1.38	330	22.20	1.44	434	22.88	1.38	415	23.93	1.62	431	25.01	1.85	434	25.88	1.88	480	26.92	1.92	443	27.90	2.09	368	29.12	2.32	213
Utah	21.30	1.13	161	21.96	1.15	245	22.72	1.34	308	23.70	1.43	364	24.58	1.75	441	25.36	1.70	411	26.18	1.69	347	27.30	1.89	216	28.45	2.13	111

CHEST GIRTH AT ARMSCYE

Alabama	60.23	2.79	283	61.82	2.77	436	63.94	3.27	483	65.53	3.22	495	68.02	3.72	548	69.91	4.25	510	71.97	4.85	533	74.82	5.00	458	78.64	6.09	410
California	61.08	2.76	237	63.23	3.08	234	65.85	3.81	264	68.13	3.76	296	71.01	5.23	274	73.34	5.03	283	75.66	5.32	278	79.15	5.98	284	82.95	6.16	277
Colorado	60.23	2.82	263	61.84	3.35	298	64.19	3.32	362	66.73	3.76	366	68.71	3.86	399	70.93	4.14	372	73.46	4.97	414	74.53	5.23	328	79.61	6.16	294
District of Columbia, Maryland, and Virginia	60.49	3.02	430	62.39	3.42	502	64.76	3.86	535	66.97	4.04	608	68.94	4.60	604	70.98	4.45	582	74.27	5.61	917	77.23	5.84	1,117	80.71	6.17	894
Illinois	61.02	3.46	165	62.86	3.46	270	64.96	3.99	348	66.66	3.60	353	69.00	4.27	397	71.41	4.91	409	73.91	5.42	411	77.03	5.66	406	80.65	6.77	282
Iowa	59.74	2.92	417	61.83	3.21	429	64.41	3.68	544	66.54	3.80	483	68.51	4.36	554	71.22	5.06	501	73.02	5.27	321	76.75	5.53	229	79.90	6.63	168
Kansas	60.38	2.80	220	62.32	3.15	320	64.84	3.57	346	66.85	4.00	332	68.99	3.86	359	71.16	4.46	354	74.18	5.07	518	76.63	5.21	512	80.31	6.02	398
Michigan	60.50	2.99	176	62.82	3.51	248	64.98	3.85	345	67.01	3.93	360	69.31	4.36	465	71.51	4.92	409	73.29	4.86	419	76.47	5.56	278	81.25	6.54	225
Minnesota	59.87	3.05	563	61.94	3.05	559	64.35	3.57	577	66.44	3.89	687	68.37	4.27	617	70.81	4.61	629	73.57	5.10	542	76.50	5.80	601	80.21	6.18	473
Nebraska	60.11	2.92	203	62.45	3.21	221	64.09	3.59	225	66.51	4.07	232	69.26	3.98	247	70.51	4.34	202	71.83	4.59	162	75.69	5.42	134	78.98	5.30	52
Ohio	60.14	3.24	294	61.84	3.20	392	64.03	3.55	488	66.51	3.77	576	68.70	4.01	581	70.79	4.25	606	73.26	4.95	558	76.38	5.53	519	79.00	5.87	356
Pennsylvania	60.16	3.10	253	62.26	3.27	290	64.38	3.41	299	66.84	4.36	316	68.63	4.90	345	71.49	4.99	336	74.06	5.19	413	77.08	6.06	461	81.57	6.41	429
Tennessee	58.82	2.85	162	61.11	3.24	220	63.19	3.61	354	65.04	3.80	343	66.73	4.15	381	68.71	4.08	404	71.32	4.61	336	74.85	5.58	344	78.25	5.82	195
Texas	60.77	3.34	330	62.87	3.76	434	64.77	3.59	415	67.27	3.95	431	69.55	4.42	434	71.86	4.55	480	74.22	5.09	443	76.62	5.51	368	79.39	5.59	213
Utah	60.59	2.82	161	62.69	3.12	245	64.54	3.55	308	67.08	3.65	364	69.23	4.31	441	71.27	4.25	411	73.54	4.47	347	76.25	5.05	216	79.28	5.44	111

WAIST GIRTH

Alabama	54.15	2.94	283	55.17	2.69	436	56.32	3.17	483	57.61	3.37	495	59.31	3.75	548	60.63	4.50	510	61.98	4.79	533	63.55	4.25	458	66.03	4.96	410
California	54.59	3.00	237	55.17	3.00	234	57.30	3.81	264	58.64	3.69	296	60.89	5.07	274	62.12	5.21	283	63.71	5.43	278	65.38	5.59	284	68.08	5.90	277
Colorado	53.32	2.65	263	54.28	2.96	298	55.68	3.21	362	57.44	3.76	366	58.51	3.85	399	59.84	3.89	372	61.56	4.73	414	63.73	4.74	328	65.16	4.36	294
District of Columbia, Maryland, and Virginia	53.80	2.88	430	55.02	3.37	502	56.57	3.76	535	58.06	4.01	608	59.23	4.39	604	60.74	4.30	582	63.24	5.84	917	64.81	5.36	1,117	66.93	5.54	894
Illinois	54.31	3.50	165	55.31	3.26	270	56.63	4.05	348	57.84	3.77	353	59.16	4.17	397	60.87	4.96	409	62.68	5.23	411	64.45	5.07	406	66.33	5.12	282
Iowa	53.85	2.88	417	55.02	3.14	429	56.94	3.71	544	58.20	3.93	483	59.42	4.17	554	61.60	5.22	501	62.25	4.72	321	64.82	5.44	229	66.65	5.59	168
Kansas	53.70	2.94	220	54.83	3.04	320	56.63	3.58	346	57.77	4.08	332	58.95	3.68	359	60.44	4.19	354	62.97	5.01	518	64.10	4.58	512	66.39	4.85	398
Michigan	53.42	3.20	176	54.52	3.02	248	56.09	3.54	345	57.01	3.57	360	58.60	4.12	465	60.30	4.88	409	61.23	4.49	419	63.35	5.32	278	65.91	4.74	225
Minnesota	53.16	3.13	563	54.41	3.15	559	55.91	3.42	577	57.39	3.98	687	58.40	4.30	617	59.93	4.69	629	61.58	4.75	542	63.52	5.02	601	65.51	4.10	473
Nebraska	53.43	2.66	203	54.97	3.28	221	55.88	3.36	225	57.48	3.95	232	59.21	4.06	247	60.01	4.06	202	60.90	4.01	162	63.32	4.55	134	65.13	4.45	52
Ohio	53.39	3.29	294	54.49	2.86	392	55.54	3.29	488	57.27	3.57	576	58.66	3.99	581	60.06	4.43	606	61.67	5.03	558	63.76	4.89	519	65.16	4.89	356
Pennsylvania																											

TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14—Continued

NECK-BASE GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	28.89	1.49	283	29.86	1.34	436	30.60	1.44	483	31.30	1.37	495	32.06	1.54	548	32.63	1.63	510	33.39	1.75	533	34.50	2.01	458	35.86	2.36	410
California	29.26	1.27	237	29.97	1.34	234	30.78	1.40	264	31.60	1.47	296	32.49	1.73	274	33.16	1.67	283	33.87	1.91	278	35.53	2.19	284	37.09	2.46	277
Colorado	29.04	1.39	263	29.59	1.57	298	30.50	1.54	362	31.34	1.70	366	31.99	1.58	399	32.63	1.62	372	33.62	1.86	414	34.71	2.12	328	35.66	2.32	294
District of Columbia, Maryland, and Vir- ginia	29.08	1.60	430	29.85	1.60	502	30.66	1.63	535	31.37	1.60	608	31.95	1.67	604	32.74	1.91	582	33.86	2.15	917	34.82	2.31	1,117	36.12	2.52	894
Illinois	29.57	1.49	165	30.20	1.64	270	30.78	1.73	348	31.44	1.67	353	32.04	1.84	397	32.89	1.93	409	33.84	1.96	411	35.06	2.36	406	36.65	2.45	282
Iowa	29.30	1.29	417	29.97	1.35	429	30.69	1.46	544	31.33	1.54	483	31.87	1.49	554	32.70	1.71	501	33.34	1.78	321	34.54	2.03	229	36.15	2.39	168
Kansas	29.37	1.47	220	29.98	1.42	320	31.05	1.57	346	31.63	1.60	332	32.28	1.63	359	32.81	1.72	354	34.13	1.86	518	35.11	2.11	512	36.30	3.32	398
Michigan	29.15	1.44	176	30.00	1.44	248	30.80	1.47	345	31.40	1.56	360	32.15	1.62	465	32.90	1.73	409	33.45	1.83	419	34.59	2.19	278	36.44	2.49	225
Minnesota	29.46	1.40	563	30.17	1.44	559	31.05	1.53	577	31.68	1.61	687	32.17	1.64	617	32.97	1.71	629	33.80	1.75	542	34.73	2.12	601	36.21	2.38	473
Nebraska	29.89	1.44	203	30.64	1.48	221	31.14	1.55	225	31.92	1.49	232	32.74	1.60	247	33.11	1.62	202	33.69	1.65	162	35.17	2.13	134	36.15	2.23	52
Ohio	29.62	1.38	294	30.41	1.44	392	31.03	1.55	488	31.90	1.54	576	32.49	1.59	581	33.17	1.65	606	33.96	1.85	558	35.08	2.13	519	36.05	2.13	356
Pennsylvania	29.28	1.69	253	30.25	1.69	290	31.15	1.85	299	31.89	2.02	316	32.53	2.11	345	33.04	1.99	336	33.78	2.03	413	34.96	2.36	461	36.44	2.61	429
Tennessee	29.13	1.40	162	30.08	1.49	220	31.01	1.52	354	31.60	1.55	343	32.26	1.73	381	32.89	1.55	404	33.71	1.85	336	34.92	2.20	344	36.22	2.62	195
Texas	28.83	1.42	330	29.69	1.45	434	30.18	1.45	415	31.12	1.62	431	31.72	1.75	434	32.35	1.74	480	32.95	1.89	443	34.02	2.08	368	35.10	2.08	213
Utah	29.31	1.32	161	30.07	1.37	245	30.64	1.52	308	31.49	1.52	364	32.17	1.68	441	32.62	1.69	411	33.30	1.78	347	34.35	2.02	216	35.49	2.08	111

ARMSCYE GIRTH

Alabama	26.97	1.56	283	27.95	1.52	436	29.10	1.83	483	30.12	1.69	495	31.41	2.08	548	32.49	2.29	510	33.68	2.44	533	35.32	2.62	458	37.38	3.12	410
California	27.58	1.63	237	28.79	1.64	234	30.35	1.86	264	31.47	2.07	296	32.93	2.55	274	34.37	2.37	283	36.22	2.73	278	39.01	3.24	284	41.40	3.19	277
Colorado	27.74	1.62	263	28.50	1.78	298	29.91	2.01	362	31.27	1.95	366	32.28	2.05	399	33.37	2.19	372	34.64	2.46	414	36.33	2.65	328	37.85	2.82	294
District of Columbia, Maryland, and Vir- ginia	27.72	1.86	430	28.92	2.02	502	30.02	2.07	535	31.35	2.14	608	32.37	2.33	604	33.64	2.39	582	35.30	2.95	917	36.94	3.11	1,117	38.70	3.14	894
Illinois	28.24	1.93	165	29.37	1.90	270	30.48	2.21	348	31.53	1.98	353	32.63	2.30	397	33.93	2.51	409	35.43	2.65	411	36.91	2.97	406	38.78	3.04	282
Iowa	27.41	1.63	417	28.72	1.78	429	30.01	1.96	544	31.27	2.04	483	32.40	2.30	554	33.85	2.41	501	34.69	2.72	321	36.84	2.86	229	38.70	3.47	168
Kansas	27.30	1.69	220	28.59	1.89	320	29.72	2.06	346	30.95	2.04	332	32.05	2.10	359	33.28	2.14	354	34.88	2.58	518	36.17	2.61	512	38.00	2.93	398
Michigan	27.25	1.85	176	28.53	1.75	248	29.72	2.01	345	30.74	1.86	360	31.92	2.10	465	33.01	2.29	409	33.83	2.22	419	35.40	2.68	278	37.71	2.97	225
Minnesota	27.48	1.87	563	28.65	1.92	559	29.83	2.13	577	30.97	2.21	687	31.87	2.30	617	33.22	2.42	629	34.69	2.65	542	36.27	2.93	601	38.26	3.16	473
Nebraska	27.66	1.57	203	28.87	1.65	221	29.80	1.72	225	31.13	2.06	232	32.43	2.15	247	33.23	2.20	202	34.19	2.27	162	36.27	2.79	134	37.73	2.71	52
Ohio	27.84	1.77	294	28.89	1.72	392	29.89	1.85	488	31.19	1.99	576	32.29	2.09	581	33.32	2.26	606	34.63	2.39	558	36.37	2.78	519	37.90	2.93	356
Pennsylvania	27.26	1.83	253	28.41	2.11	290	29.99	2.31	299	31.18	2.67	316	32.12	2.87	345	33.51	2.60	336	35.02	2.89	413	36.88	3.30	461	39.04	3.41	429
Tennessee	27.38	1.73	162	28.80	1.81	220	29.92	1.86	354	31.08	1.95	343	32.03	2.11	381	32.82	2.02	404	34.31	2.38	336	36.01	2.76	344	38.04	2.80	195
Texas	27.40	1.78	330	28.74	1.84	434	29.63	1.91	415	31.14	2.02	431	32.30	2.32	434	33.61	2.31	480	34.85	2.43	443	36.17	2.77	368	37.72	2.71	213
Utah	27.65	1.68	161	28.88	1.74	245	29.73	1.84	308	31.02	1.96	364	32.23	2.16	441	33.19	2.29	411	34.16	2.42	347	35.81	2.54	216	37.48	2.70	111

UPPER-ARM GIRTH

Alabama	16.92	1.18	283	17.24	1.33	436	17.67	1.43	483	18.25	1.47	495	18.98	1.74	548	19.52	1.97	510	20.26	2.16	533	21.06	2.13	458	22.24	2.38	410
California	17.56	1.25	237	18.09	1.32	234	18.95	1.74	264	19.64	1.65	296	20.58	2.26	274	21.43	2.36	283	22.24	2.38	278	23.38	2.35	284	24.63	2.58	277
Colorado	17.23	1.20	263	17.66	1.34	298	18.29	1.58	362	19.08	1.80	366	19.56	1.70	399	20.25	1.95	372	20.98	2.21	414	22.09	2.26	328	22.88	2.39	294
District of Columbia, Maryland, and Vir- ginia	17.39	1.44	430	17.87	1.54	502	18.44	1.67	535	19.20	1.85	608	19.88	2.04	604	20.50	2.03	582	21.65	2.55	917	22.47	2.45	1,117	23.46	2.48	894
Illinois	17.81	1.64	165	18.26	1.58	270	18.76	1.91	348	19.31	1.78	353	20.00	2.09	397	20.85	2.29	409	21.58	2.41	411	22.37	2.30	406	23.51	2.51	282
Iowa	17.37	1.30	417	17.83	1.39	429	18.51	1.69	544	19.14	1.79	483	19.83	1.90	554	20.69	2.16	501	21.10	2.21	321	22.36	2.37	229	23.35	2.67	168
Kansas	17.25	1.28	220	17.62	1.48	320	18.36	1.65	346	18.99	1.68	332	19.64	1.82	359	20.25	1.89	354	21.42	2.24	518	22.21	2.16	512	23.34	2.37	398
Michigan	17.38	1.50	176	18.03	1.36	248	18.79	1.62	345	19.21	1.66	360	20.01	1.83	465	20.76	2.17	409	21.16	1.97	419	22.19	2.27	278	23.60	2.31	225
Minnesota	17.26	1.33	563	17.87	1.44	559	18.44	1.65	577	19.12	1.78	687	19.66	2.05	617	20.35	2.05	629	21.14	2.16	542	21.99	2.31	601	23.05	2.40	473
Nebraska	17.30	1.49	203	17.95	1.47	221	18.39	1.62	225	19.04	1.81	232	19.86	1.99	247	20.34	2.00	202	20.81	1.97	162	21.98	2.27	134	22.85	2.14	52
Ohio	17.23	1.49	294	17.67	1.32	392	18.14	1.48	488	18.96	1.68	576	19.56	1.70	581	20.23	1.96	606	20.94	2.16	558	21.99	2.40	519	22.82	2.27	356
Pennsylvania	17.03	1.31	253	17.51	1.33	290	18.46	1.54	299	18.99	1.80	316	19.58	2.23	345	20.49	2.18	336	21.32	2.24	413	22.54	2.60	461	23.67	2.62	429
Tennessee	16.81	1.31	162	17.39	1.44	220	17.94	1.63	354	18.55	1.62	343	19.04	1.85	381	19.58	1.71	404	20.34	1.96	336	21.46	2.24	344	22.60	2.45	195
Texas	17.38	1.50	330	17.98	1.66	434	18.43	1.56	415	19.19	1.83	431	19.04	2.11	434	20.73	2.12	480	21.42	2.29	443	22.04	2.41	368	22.95	2.28	213
Utah	17.34	1.11	161	17.79	1.30	245	18.34	1.47	308	19.14	1.57	364	19.77	1.96	441	20.33	1.88	411	20.95	1.84	347	21.83	2.04	216	22.88	2.08	111

TOTAL POSTERIOR ARM LENGTH



TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14—Continued

THIGH GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	33.61	2.31	283	34.69	2.71	436	35.88	2.99	483	37.47	3.11	495	39.21	3.63	548	40.50	4.09	510	41.98	4.45	533	43.44	4.22	458	45.56	4.72	410
California	34.88	2.48	237	36.29	2.86	234	38.56	3.70	264	40.32	3.35	296	42.35	4.54	274	44.20	4.76	283	45.81	4.67	278	47.35	4.49	284	49.55	4.70	277
Colorado	33.50	2.43	263	34.66	2.66	298	36.21	3.06	362	38.21	3.60	366	39.41	3.67	399	41.24	3.89	372	42.63	4.32	414	44.69	4.22	328	45.76	4.18	294
District of Columbia, Maryland, and Virginia	34.49	2.74	430	35.76	3.06	502	37.35	3.50	535	39.17	3.83	608	40.54	4.07	604	42.09	4.17	582	44.63	4.89	917	46.14	4.81	1,117	47.99	4.78	894
Illinois	35.04	3.26	165	36.06	3.13	270	37.56	3.78	348	38.75	3.49	353	40.31	4.16	397	42.19	4.60	409	43.58	4.72	411	45.29	4.58	406	47.03	4.65	282
Iowa	34.20	2.75	417	35.58	2.85	429	37.42	3.41	544	38.98	3.71	483	40.69	4.07	554	42.81	4.54	501	43.60	4.56	521	45.94	4.76	229	47.63	5.11	168
Kansas	33.85	2.36	220	35.05	2.91	320	37.20	3.34	346	38.32	3.47	332	40.10	3.89	359	41.59	4.05	354	44.21	4.63	518	45.61	4.23	512	47.11	4.22	398
Michigan	34.31	2.79	176	35.75	2.73	248	37.43	3.55	345	38.58	3.35	360	40.29	3.95	465	42.02	4.34	409	42.70	3.91	419	44.44	4.32	278	46.58	3.87	225
Minnesota	34.12	2.74	563	35.63	3.02	559	37.10	3.31	577	39.00	3.69	687	40.27	4.06	617	41.83	4.21	629	43.58	4.43	542	45.29	4.67	601	47.20	4.60	473
Nebraska	34.27	2.76	203	35.74	3.04	221	36.98	3.37	225	38.73	3.83	232	40.54	3.95	247	41.51	4.12	202	42.74	4.01	162	45.08	4.37	134	46.27	3.68	52
Ohio	34.09	3.00	294	35.23	2.74	392	36.50	3.15	488	38.43	3.40	576	39.92	3.82	581	41.51	4.16	606	43.01	4.31	558	45.14	4.53	519	46.30	4.46	356
Pennsylvania	33.92	2.75	253	35.47	2.83	290	37.26	3.28	299	38.93	3.93	316	40.34	4.52	345	42.35	4.56	336	44.22	4.61	413	46.21	5.01	461	47.98	4.48	429
Tennessee	32.77	2.42	162	34.50	2.88	220	35.85	3.50	354	37.34	3.54	343	38.92	3.73	381	39.95	3.55	404	42.10	4.21	336	43.83	4.53	344	46.04	4.43	195
Texas	34.62	3.11	330	36.12	3.47	434	37.22	3.34	415	39.18	3.96	431	41.16	4.45	434	42.71	4.47	480	44.44	4.63	443	45.31	4.46	368	47.11	4.27	213
Utah	34.00	2.44	161	35.16	2.56	245	36.33	3.03	308	38.42	3.21	364	39.92	4.03	441	41.17	3.68	411	42.49	3.67	347	44.04	3.79	216	45.33	3.76	111

MAXIMUM CALF GIRTH

Alabama	23.24	1.38	283	24.04	1.59	436	24.80	1.67	483	25.67	1.77	495	26.72	2.08	548	27.48	2.20	510	28.40	2.45	533	29.62	2.54	458	30.92	2.58	410
California	23.96	1.60	237	24.88	1.72	234	25.97	2.06	264	26.89	1.83	296	28.22	2.42	274	29.25	2.59	283	30.24	2.57	278	31.55	2.73	284	32.86	2.67	277
Colorado	23.11	1.38	263	23.90	1.67	298	24.81	1.84	362	26.05	1.95	366	26.78	2.01	399	27.76	2.07	372	28.90	2.42	414	30.21	2.45	328	31.04	2.57	294
District of Columbia, Maryland, and Virginia	23.68	1.58	430	24.40	1.66	502	25.32	1.86	535	26.33	1.97	608	27.16	2.02	604	28.07	2.11	582	29.61	2.61	917	30.90	2.74	1,117	32.34	2.69	894
Illinois	24.01	1.84	165	24.75	1.73	270	25.57	1.96	348	26.29	1.89	353	27.25	2.11	397	28.30	2.34	409	29.46	2.64	411	30.59	2.62	406	31.93	2.82	282
Iowa	23.25	1.62	417	24.19	1.59	429	25.22	1.89	544	26.20	1.86	483	27.19	2.10	554	28.29	2.29	501	29.08	2.65	521	30.57	2.67	229	31.95	2.89	168
Kansas	23.34	1.41	220	24.22	1.75	320	25.39	1.90	346	26.25	2.04	332	27.20	2.00	359	28.20	2.14	354	29.69	2.53	518	30.82	2.42	512	32.13	2.59	398
Michigan	23.70	1.67	176	24.56	1.62	248	25.62	1.84	345	26.28	1.79	360	27.22	2.10	465	28.33	2.29	409	28.88	2.13	419	30.22	2.51	278	31.80	2.55	225
Minnesota	23.21	1.54	563	24.13	1.73	559	25.13	1.79	577	26.25	1.95	687	27.12	2.13	617	28.06	2.29	629	29.23	2.46	542	30.65	2.69	601	32.04	2.64	473
Nebraska	23.50	1.56	203	24.56	1.67	221	25.46	1.92	225	26.20	1.97	232	27.40	1.98	247	27.96	2.15	202	28.81	2.17	162	30.42	2.52	134	31.35	2.29	52
Ohio	23.66	2.26	294	24.40	1.54	392	25.07	1.82	488	26.24	1.89	576	27.08	2.00	581	27.97	2.22	606	29.02	2.31	558	30.35	2.58	519	31.33	2.70	356
Pennsylvania	23.49	1.68	253	24.26	1.53	290	25.38	2.10	299	26.17	2.02	316	27.06	2.28	345	28.21	2.26	336	29.32	2.53	413	30.59	2.71	461	32.12	2.94	429
Tennessee	22.97	1.47	162	23.99	1.55	220	24.87	1.97	354	25.80	1.91	343	26.67	2.02	381	27.42	2.05	404	28.61	2.43	336	29.86	2.66	344	31.53	2.55	195
Texas	23.80	1.67	330	24.71	1.88	434	25.48	1.78	415	26.86	1.99	431	27.62	2.19	434	28.60	2.24	480	29.71	2.39	443	30.64	2.66	368	31.87	2.60	213
Utah	23.31	1.42	161	24.16	1.44	245	24.93	1.73	308	26.10	1.79	364	26.94	2.12	441	27.71	2.08	411	28.52	2.10	347	29.73	2.27	216	30.75	2.25	111

KNEE GIRTH

Alabama	24.94	1.42	283	25.89	1.46	436	26.71	1.61	483	27.65	1.65	495	28.77	1.85	548	29.70	2.10	510	30.65	2.32	533	31.87	2.26	458	33.25	2.42	410
California	25.29	1.43	237	26.34	1.51	234	27.53	1.97	264	28.68	1.75	296	29.87	2.29	274	31.04	2.31	283	32.11	2.45	278	33.30	2.26	284	34.40	2.19	277
Colorado	24.81	1.34	263	25.55	1.56	298	26.72	1.76	362	27.76	1.83	366	28.63	1.95	399	29.73	2.00	372	30.89	2.27	414	32.11	2.28	328	32.90	2.22	294
District of Columbia, Maryland, and Virginia	25.03	1.59	430	25.88	1.78	502	26.95	1.92	535	28.01	1.99	608	29.05	2.05	604	29.96	2.15	582	31.68	2.59	917	32.96	2.54	1,117	34.10	2.36	894
Illinois	25.38	1.56	165	26.33	1.56	270	27.22	1.90	348	28.10	1.77	353	29.17	2.12	397	30.31	2.30	409	31.37	2.39	411	32.51	2.41	406	33.59	2.38	282
Iowa	24.62	1.52	417	25.60	1.49	429	26.76	1.77	544	27.80	1.75	483	28.82	1.91	554	30.06	2.15	501	30.84	2.41	521	32.37	2.51	229	33.39	2.52	168
Kansas	25.21	1.50	220	26.10	1.75	320	27.41	1.80	346	28.34	1.87	332	29.47	2.07	359	30.47	2.04	354	32.03	2.40	518	33.10	2.28	512	34.20	2.28	398
Michigan	25.22	1.59	176	26.05	1.53	248	27.25	1.91	345	28.07	1.80	360	29.21	2.05	465	30.28	2.27	409	31.01	2.14	419	32.37	2.42	278	33.65	2.12	225
Minnesota	24.83	1.53	563	25.77	1.58	559	26.89	1.73	577	28.01	2.00	687	28.81	2.07	617	28.84	2.15	629	31.04	2.29	542	32.25	2.48	601	33.45	2.38	473
Nebraska	24.77	1.53	203	26.00	1.70	221	26.95	1.87	225	28.13	1.95	232	28.98	1.91	247	29.75	2.22	202	30.52	2.09	162	32.12	2.38	134	33.19	2.34	52
Ohio	24.76	1.62	294	25.53	1.60	392	26.48	1.70	488	27.74	1.94	576	28.65	2.02	581	29.59	2.08	606	30.67								

TABLE 39.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for boys aged 6 to 14—Continued

VERTICAL TRUNK GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	104.16	3.91	283	107.59	4.56	436	110.89	4.83	483	114.16	4.83	495	118.23	5.64	548	121.64	6.33	510	125.61	7.22	533	130.91	8.46	458	137.72	9.66	410
California	105.92	4.49	237	109.42	4.85	234	113.79	5.45	204	117.89	5.23	296	121.65	6.62	274	125.83	6.65	283	130.64	7.40	278	137.98	9.15	284	144.71	9.00	277
Colorado	103.94	5.14	263	107.08	5.76	298	111.32	5.51	362	115.76	5.75	366	119.06	6.14	399	122.60	6.63	372	127.53	7.65	414	133.07	8.18	328	138.85	9.58	294
District of Columbia, Maryland, and Virginia	105.50	4.94	430	108.86	5.18	502	112.99	5.91	535	116.66	5.89	608	119.99	6.18	604	123.77	6.71	582	129.19	8.07	917	134.67	9.16	1,117	140.99	9.28	894
Illinois	105.99	4.80	165	109.28	4.83	270	112.51	5.60	348	115.24	5.60	353	118.86	6.48	397	123.07	7.15	409	127.27	7.56	411	133.08	9.24	406	139.06	9.46	282
Iowa	104.06	4.71	417	107.91	4.60	429	112.07	5.29	544	115.67	5.36	483	118.93	6.44	554	123.10	6.66	501	126.23	7.73	321	132.44	8.83	229	139.15	10.58	168
Kansas	104.18	4.66	220	107.68	4.94	320	112.12	5.41	346	115.32	5.72	332	119.12	5.96	359	122.62	6.78	354	127.93	7.82	518	133.16	8.29	512	139.31	9.21	398
Michigan	104.22	5.27	176	108.00	4.75	248	111.78	5.41	345	114.83	5.07	360	118.43	6.31	465	122.14	6.73	409	124.96	6.89	419	130.74	9.13	278	139.18	10.20	225
Minnesota	103.96	5.19	563	107.74	4.68	559	111.99	5.35	577	116.00	6.02	687	119.13	6.09	617	122.94	6.72	629	127.00	7.53	542	132.59	9.11	601	139.93	10.12	473
Nebraska	103.70	4.84	203	108.04	5.23	221	111.38	5.42	225	114.97	5.83	232	118.83	5.80	247	121.42	6.87	202	124.00	7.06	162	132.10	9.13	134	138.13	9.45	52
Ohio	104.64	4.87	294	108.17	4.88	392	111.49	5.55	488	115.66	5.71	576	119.15	5.89	581	122.60	6.62	606	126.54	7.35	558	132.41	8.56	519	137.76	9.28	356
Pennsylvania	105.39	4.81	253	108.97	5.08	290	112.89	5.29	299	117.25	6.33	316	120.04	6.44	345	124.49	6.79	336	128.82	7.92	413	134.44	9.61	461	140.84	10.20	429
Tennessee	102.06	4.49	162	106.14	4.96	220	109.67	5.70	354	113.22	5.46	343	116.65	5.87	381	119.81	6.20	404	124.49	7.28	336	130.40	8.94	344	137.69	9.43	195
Texas	104.18	4.77	330	107.81	5.04	434	111.15	5.13	415	115.09	5.60	431	119.11	6.14	434	122.66	6.50	480	127.13	6.90	443	131.93	8.29	368	137.21	9.33	213
Utah	104.56	4.66	161	107.96	4.81	245	111.55	5.40	308	115.57	5.38	364	118.98	6.59	441	121.72	6.43	411	125.61	6.70	347	130.70	7.67	216	135.32	8.93	111

TABLE 40.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for girls aged 6 to 14

WAIST HEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	71.62	3.67	340	74.99	3.73	450	79.21	4.44	487	82.98	4.42	541	87.27	4.73	584	91.90	5.18	562	95.71	5.07	567	99.22	4.72	544	101.28	4.56	421
California	72.69	3.91	245	76.92	4.31	264	81.30	4.40	261	85.35	4.94	271	89.64	4.80	271	93.73	5.41	274	97.59	5.33	274	100.04	4.74	226	101.38	4.97	188
Colorado	71.03	3.83	295	75.46	4.25	320	79.39	4.33	396	83.56	4.55	392	87.63	4.90	419	91.37	5.24	369	95.47	5.09	345	99.00	4.77	265	101.38	4.99	172
District of Columbia, Maryland, and Virginia	72.84	3.79	436	76.86	4.40	522	80.75	4.93	561	84.72	5.15	556	88.59	5.15	538	92.94	5.69	478	97.80	5.06	680	100.18	4.52	641	101.12	4.13	470
Illinois	73.19	5.18	196	76.99	4.78	260	80.52	5.02	305	83.51	5.03	334	88.02	5.45	382	92.09	5.60	407	95.37	5.04	351	97.97	5.21	299	100.39	5.01	156
Iowa	71.58	3.72	445	75.71	4.00	535	80.21	4.70	492	83.87	4.70	539	87.97	5.01	542	92.04	5.19	540	95.87	5.07	323	98.17	4.91	181	100.93	4.60	134
Kansas	71.43	4.16	305	75.81	4.27	364	80.08	4.19	364	83.54	4.93	412	88.04	4.86	409	92.73	5.31	473	96.37	5.21	580	99.11	4.54	638	100.44	4.29	504
Michigan	71.70	5.10	80	75.87	4.84	100	79.94	4.75	159	83.77	4.66	176	88.29	5.05	208	91.32	5.33	219	94.92	5.19	153	96.38	4.97	72	99.90	3.63	60
Minnesota	71.78	4.02	594	76.33	4.25	560	80.94	4.77	594	84.68	4.69	699	88.76	4.79	660	92.72	5.15	635	96.97	5.38	514	100.29	4.65	603	101.79	4.40	469
Nebraska	71.90	4.09	211	75.81	3.95	210	80.27	4.68	238	84.37	4.58	267	88.16	4.88	264	92.99	5.55	194	95.60	5.27	171	99.20	4.64	118	100.46	5.47	41
Ohio	71.62	4.69	211	75.03	4.13	250	79.01	4.25	300	82.95	4.76	328	86.67	4.82	311	90.67	5.10	298	95.33	4.79	247	97.56	4.71	197	99.95	4.36	124
Pennsylvania	71.62	3.97	361	75.74	4.39	438	79.83	4.81	374	83.35	4.83	477	88.07	4.88	436	91.82	5.57	477	95.14	5.66	549	98.49	4.70	545	99.85	4.44	405
Tennessee	71.27	4.52	262	74.89	4.46	398	78.99	4.65	357	82.82	4.78	396	86.40	5.31	377	90.55	4.82	322	94.93	5.47	302	98.08	4.75	232	99.59	4.43	149
Texas	71.96	4.11	346	75.66	4.05	472	79.88	4.35	518	83.48	4.62	435	88.17	4.59	453	92.35	4.90	532	96.58	4.82	576	99.27	4.12	443	101.08	4.09	304
Utah	72.41	4.18	232	76.91	4.90	274	79.99	4.60	348	84.02	4.87	351	87.81	4.95	399	91.86	5.52	352	95.43	5.10	253	98.39	5.00	129	99.86	5.33	36

HIP HEIGHT

Alabama	57.55	3.23	340	60.20	3.24	450	63.89	3.81	487	67.09	3.75	541	70.63	4.00	584	74.50	4.36	562	77.43	4.24	567	80.13	4.11	544	81.48	4.01	421
California	57.89	3.35	245	61.48	3.58	264	65.34	3.70	261	68.60	4.27	271	72.28	4.03	271	75.69	4.70	274	78.80	4.51	274	80.54	4.32	226	81.41	4.41	188
Colorado	57.12	3.32	295	60.85	3.77	320	64.23	3.87	396	67.41	3.92	392	71.07	4.12	419	74.24	4.46	369	77.42	4.26	345	79.97	4.20	265	81.80	4.33	172
District of Columbia, Maryland, and Virginia	58.63	3.31	436	61.39	3.74	522	64.56	4.06	561	67.95	4.32	556	70.97	4.33	538	74.62	4.81	478	78.45	4.40	680	80.21	4.18	641	80.94	3.87	470
Illinois	58.61	4.36	196	61.83	4.25	260	64.70	4.18	305	67.28	4.36	334	71.12	4.69	382	74.23	4.74	407	76.91	4.18	351	78.90	4.49	299	80.39	4.27	156
Iowa	56.80	3.11	445	60.29	3.40	535	63.93	3.86	492	67.12	3.87	539	70.32	4.13	542	73.55	4.28	540	76.84	4.18	323	78.40	4.05	181	80.41	4.14	134
Kansas	57.08	3.36	305	60.86	3.57	364	64.33	3.70	364	67.36	4.35	412	71.19	4.14	409	75.07	4.53	473	77.67	4.46	580	79.72	3.96	638	80.49	4.04	504
Michigan	57.89	3.99	80	61.37	4.07	100	64.67	3.95	159	67.95	3.81	176	71.52	4.12	208	73.95	4.23	219	76.76	4.23	133	78.19	4.35	72	80.98	3.65	60
Minnesota	57.18	3.39	594	60.91	3.60	560	64.76	4.02	594	67.86	4.00	699	71.20	3.93	660	74.26	4.29	635	77.63	4.45	514	80.25	4.09	603	81.16	3.93	469

TABLE 40.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for girls aged 6 to 14—Continued

WEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	45.89	5.89	340	49.98	7.12	450	54.69	8.05	487	60.49	9.47	541	67.83	11.87	584	75.54	12.99	562	85.13	16.80	567	96.03	17.58	544	103.45	16.00	421
California	49.37	6.92	245	54.87	8.91	264	61.57	9.87	261	69.63	12.16	271	77.84	13.31	271	87.05	15.92	274	106.82	18.94	274	106.82	18.94	226	112.82	16.91	188
Colorado	44.85	6.28	295	50.04	7.13	320	55.52	8.43	396	61.65	10.27	392	67.83	12.02	419	75.46	14.00	369	85.60	15.70	345	95.99	15.86	265	105.36	14.89	172
District of Columbia, Maryland, and Vir- ginia	47.58	6.95	436	52.34	7.85	522	58.06	9.80	561	63.89	11.32	556	71.10	13.23	538	79.46	15.38	478	92.15	17.06	680	101.46	16.66	641	105.51	15.54	470
Illinois	49.65	9.34	196	53.83	9.31	260	59.12	9.85	305	64.55	12.95	334	72.51	14.58	382	81.26	16.46	407	89.14	16.42	351	99.59	18.20	299	108.38	16.59	156
Iowa	46.06	5.78	445	51.63	7.15	535	57.94	9.96	492	63.72	10.75	539	70.87	12.92	542	78.94	13.74	540	89.49	15.90	323	97.17	18.40	181	106.02	17.76	134
Kansas	45.80	6.28	305	51.74	8.14	364	57.01	8.15	364	62.97	10.81	412	69.89	11.72	409	80.59	15.28	473	91.10	18.13	580	99.12	16.81	638	107.37	16.27	504
Michigan	47.38	8.24	80	52.54	8.48	100	59.74	10.53	159	63.88	11.26	176	71.71	14.16	208	78.32	14.46	219	85.00	13.91	133	91.60	13.73	72	103.70	17.40	60
Minnesota	45.49	6.57	594	51.76	8.33	560	57.85	9.75	594	63.84	10.94	699	70.78	12.47	660	80.24	15.47	635	90.87	16.83	514	101.19	15.72	603	108.61	15.41	469
Nebraska	45.86	7.23	211	50.26	7.25	210	56.40	9.16	238	62.97	10.59	267	69.02	11.90	264	79.91	16.63	194	86.98	16.39	171	95.76	15.46	118	104.68	15.15	41
Ohio	46.36	7.38	211	50.48	8.82	250	55.75	8.14	300	62.48	11.19	328	68.42	12.72	311	75.64	12.83	298	87.84	15.83	247	96.81	17.17	197	104.89	17.91	124
Pennsylvania	46.23	7.07	361	51.40	8.48	438	57.22	10.60	374	62.52	11.56	477	71.24	14.20	436	79.98	16.90	477	89.33	18.37	549	100.66	17.97	545	106.27	14.96	405
Tennessee	45.90	6.48	262	49.84	8.48	398	55.48	9.20	357	60.70	10.04	396	67.25	13.41	377	74.71	13.97	322	85.24	15.81	302	92.84	14.80	232	100.16	14.55	149
Texas	47.20	7.09	346	51.64	7.73	472	57.03	9.94	518	63.14	11.00	435	71.43	12.08	453	79.05	14.03	532	89.78	15.72	576	98.82	17.08	443	105.49	15.06	304
Utah	45.75	5.89	232	51.80	8.32	274	55.44	8.33	348	61.91	9.91	351	67.45	10.44	399	75.69	13.12	352	84.45	14.55	253	92.50	15.00	129	97.42	10.64	36

STATURE

Alabama	116.80	5.02	340	121.21	5.03	450	126.78	5.86	487	131.79	5.70	541	137.53	6.35	584	143.89	7.10	562	149.78	7.24	567	155.45	6.73	544	158.67	6.36	421
California	118.31	5.19	245	123.89	5.62	264	129.77	5.96	261	135.16	6.35	271	140.86	6.47	271	146.85	7.46	274	152.29	7.69	274	156.48	6.78	226	158.86	6.71	188
Colorado	116.11	5.32	295	122.03	5.59	320	127.41	5.71	396	132.86	5.98	392	138.24	6.46	419	143.39	7.18	369	149.43	7.26	345	154.80	6.84	265	158.67	6.60	172
District of Columbia, Maryland, and Vir- ginia	117.33	5.08	436	122.64	5.68	522	127.94	6.35	561	133.02	6.64	556	138.01	6.68	538	144.30	7.65	478	151.32	7.23	680	155.35	6.60	641	157.19	5.77	470
Illinois	118.66	6.98	196	123.62	6.47	260	128.30	6.62	305	132.31	6.58	334	138.28	7.27	382	144.22	7.60	407	149.39	7.01	351	154.02	7.49	299	157.26	6.83	156
Iowa	116.27	4.90	445	121.93	5.17	535	127.83	6.14	492	132.74	6.21	539	138.26	6.58	542	144.06	7.00	540	149.92	7.22	323	153.94	7.21	181	158.65	6.23	134
Kansas	116.51	5.59	305	122.46	5.60	364	127.91	5.53	364	132.56	6.46	412	138.62	6.56	409	145.37	7.53	473	150.74	7.57	580	155.46	6.48	638	158.22	5.98	504
Michigan	116.71	6.48	80	122.80	6.14	100	127.87	6.26	159	132.80	6.04	176	138.56	6.82	208	143.16	7.45	219	148.09	7.54	133	151.40	7.35	72	157.23	5.24	60
Minnesota	116.13	5.58	594	122.13	5.60	560	128.35	6.20	594	133.21	6.21	699	138.48	6.48	660	144.18	7.08	635	150.94	7.51	514	155.72	6.35	603	158.24	5.87	469
Nebraska	116.71	5.37	211	121.90	5.43	210	127.82	6.27	238	133.26	5.99	267	138.35	6.57	264	145.32	7.52	194	149.64	7.18	171	154.87	6.85	118	157.78	6.74	41
Ohio	116.82	6.07	211	121.32	5.29	250	126.75	5.52	300	131.98	6.31	328	136.93	6.63	311	142.55	7.05	298	149.56	6.81	247	153.56	7.00	197	157.23	6.26	124
Pennsylvania	115.78	5.28	361	121.22	5.72	438	126.63	6.13	374	131.48	6.40	477	137.58	6.64	436	143.14	7.85	477	148.48	8.21	549	154.01	6.91	545	156.30	6.04	405
Tennessee	116.43	6.05	262	121.06	6.20	398	126.63	6.00	357	131.78	6.21	396	136.46	7.10	377	142.09	6.42	322	148.62	7.58	302	153.87	6.68	232	156.83	6.12	149
Texas	117.41	5.54	346	122.38	5.35	472	128.06	5.66	518	132.69	6.18	435	139.06	6.15	453	145.03	6.92	532	151.42	7.04	576	156.00	6.02	443	159.19	5.49	304
Utah	117.94	5.49	232	123.96	6.45	274	127.89	6.15	348	133.16	6.34	351	138.33	6.48	399	143.93	7.44	352	149.26	7.34	253	153.61	6.67	129	155.89	6.36	36

CERVICAL HEIGHT

Alabama	97.16	4.51	340	100.90	4.51	450	106.13	5.29	487	110.64	5.26	541	115.99	5.91	584	122.00	6.60	562	127.23	6.79	567	132.69	6.38	544	135.58	5.92	421
California	98.45	4.70	245	103.43	5.17	260	108.81	5.47	261	113.88	6.19	271	119.23	6.02	271	124.91	7.03	274	129.89	7.15	274	133.62	6.25	226	135.97	6.16	188
Colorado	96.19	4.83	295	101.71	5.21	320	106.69	5.23	396	111.82	5.61	392	116.89	6.12	419	121.63	6.68	369	127.50	6.75	345	132.35	6.29	265	136.12	6.13	172
District of Columbia, Maryland, and Vir- ginia	97.67	4.57	436	102.28	5.01	522	107.14	5.90	561	111.96	6.25	556	116.71	6.36	538	122.60	7.12	478	129.08	6.67	680	132.77	6.01	641	134.55	5.30	470
Illinois	98.74	6.12	196	103.18	5.99	260	107.22	6.02	305	111.05	6.08	334	116.61	6.76	382	122.22	7.10	407	127.00	6.66	351	131.04	6.91	299	134.13	6.23	156
Iowa	96.62	4.41	445	101.61	4.75	535	107.04	5.67	492	111.69	5.80	539	116.97	6.28	542	122.25	6.68	540	127.59	6.70	323	131.20	6.29	181	135.64	5.80	134
Kansas	96.75	4.94	305	102.06	5.17	364	107.05	5.21	364	111.37	6.17	412	117.13	6.13	409	123.41	6.98	473	128.51	7.13	580	132.74	6.09	638	135.33	5.65	504
Michigan	96.94	6.06	80	102.42	5.65	100	107.50	5.91	159	112.05	5.70	176	117.46	6.56	208	121.99	7.04	219	126.05	7.15	133	129.72	6.76	72	135.42	4.76	60
Minnesota	96.53	4.86	594	101.96	5.09	560	107.52	5.81	594	112.14	5.75	699	117.09	6.17	660	122.52	6.70	635	128.72	7.02	514	133.32	5.96	603	135.65	5.51	469
Nebraska	97.12	4.95	211	101.80	4.74	210	106.96	5.61	238	111.96	5.63	267	116.74	6.13	264	123.30	6.99	194	127.28	6.68	171	132.11	6.25	118			

TABLE 40.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for girls aged 6 to 14—Continued

BITROCHANTERIC DIAMETER

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	21.50	1.41	340	22.23	1.45	450	23.06	1.52	487	24.04	1.70	541	25.19	1.90	584	26.45	2.07	562	28.06	2.46	567	29.80	2.52	544	31.22	2.36	421
California	21.94	1.44	245	22.67	1.62	264	23.80	1.62	261	25.06	1.92	271	26.41	1.96	271	27.64	2.20	274	29.34	2.60	274	31.23	2.49	226	32.21	1.94	188
Colorado	21.09	1.40	295	22.00	1.46	320	22.96	1.56	396	23.97	1.75	392	24.94	1.93	419	26.14	2.15	369	27.75	2.38	345	29.63	2.45	265	30.97	2.29	172
District of Columbia, Maryland, and Virginia	21.66	1.52	436	22.51	1.54	522	23.38	1.78	561	24.29	1.83	556	25.45	2.09	538	26.73	2.27	478	28.70	2.45	680	30.15	2.26	641	30.92	2.11	470
Illinois	22.25	1.87	196	22.94	1.76	260	23.76	1.83	305	24.58	2.15	334	25.85	2.31	382	27.30	2.53	407	28.66	2.46	351	30.26	2.50	299	31.60	2.24	156
Iowa	21.60	1.31	445	22.13	1.46	535	23.61	1.84	492	24.45	1.84	530	25.64	2.09	542	26.90	2.19	540	28.77	2.35	323	30.19	2.61	181	31.69	2.45	134
Kansas	21.18	1.37	305	22.31	1.63	364	23.06	1.49	364	24.04	1.91	412	25.13	1.82	409	26.82	2.31	473	28.66	2.66	580	30.12	2.54	638	31.50	2.25	504
Michigan	21.48	1.76	80	22.35	1.67	100	23.66	1.92	159	24.02	1.88	176	25.50	2.22	208	26.61	2.40	219	27.86	2.42	133	29.21	2.54	72	30.60	2.26	60
Minnesota	21.07	1.39	594	22.17	1.62	560	23.15	1.66	594	24.03	1.79	699	25.27	1.95	660	26.76	2.22	635	28.49	2.42	514	30.02	2.22	603	31.13	2.08	469
Nebraska	21.29	1.42	211	22.04	1.47	210	23.09	1.58	238	24.16	1.78	267	25.17	1.93	264	26.84	2.33	194	28.07	2.42	171	29.59	2.32	118	30.90	2.01	41
Ohio	21.26	1.52	211	22.10	1.31	250	22.89	1.51	300	24.01	1.78	329	24.94	1.98	311	25.98	2.06	298	27.94	2.32	247	29.51	2.38	197	30.76	2.04	124
Pennsylvania	21.10	1.43	361	22.07	1.65	438	22.99	1.63	374	24.01	1.96	477	25.25	2.10	436	26.68	2.49	477	28.26	2.59	549	30.13	2.51	545	30.99	2.09	405
Tennessee	21.27	1.38	262	22.04	1.61	398	23.00	1.62	357	23.87	1.82	396	24.94	2.20	377	26.11	2.26	322	27.85	2.45	302	29.26	2.26	232	30.52	2.04	149
Texas	21.63	1.41	346	22.31	1.50	472	23.17	1.58	518	24.17	1.81	435	25.51	1.83	453	26.77	2.13	532	28.51	2.40	576	30.07	2.41	443	31.09	2.05	304
Utah	21.32	1.23	232	22.27	1.50	274	22.90	1.53	348	23.85	1.78	351	24.83	1.75	399	26.21	2.15	352	27.47	2.22	253	28.76	2.22	129	29.97	1.61	36

CHEST GIRTH AT ARMSCYE

Alabama	58.80	2.94	340	60.64	3.31	450	62.26	3.58	487	64.31	3.87	541	66.84	4.54	584	69.27	4.68	562	72.34	5.55	567	75.56	5.56	544	77.74	4.86	421
California	60.19	3.55	245	62.41	3.82	264	65.02	4.14	261	67.84	4.83	271	70.56	5.10	271	73.56	5.66	274	77.30	6.61	274	80.96	6.59	226	83.24	5.51	188
Colorado	58.53	3.11	295	60.79	3.39	320	62.79	3.76	396	65.15	4.23	392	67.12	4.70	419	69.94	4.94	369	73.70	5.61	345	76.79	5.18	265	79.61	4.71	172
District of Columbia, Maryland, and Virginia	59.32	3.47	436	61.19	3.40	522	63.26	4.14	561	65.51	4.74	556	67.83	5.19	538	70.72	5.48	478	74.41	5.57	680	76.78	5.21	641	78.00	4.95	470
Illinois	60.66	4.18	196	61.84	4.11	260	64.05	4.18	305	66.28	5.35	334	69.21	5.64	382	72.16	5.96	407	75.07	5.80	351	78.18	5.92	299	80.63	5.09	156
Iowa	58.94	2.96	445	61.27	3.41	535	63.66	4.24	492	65.70	4.26	539	68.46	5.06	542	71.01	5.08	540	74.49	5.49	323	76.75	5.77	181	79.19	5.50	134
Kansas	58.93	3.05	305	61.27	3.52	364	63.16	3.63	364	65.52	4.44	412	67.82	4.48	409	71.37	5.42	473	74.57	6.15	580	76.66	5.30	638	79.18	4.95	504
Michigan	59.38	3.13	80	61.55	3.66	100	64.27	4.48	159	65.65	4.50	176	68.15	5.22	208	70.50	4.96	219	72.72	4.92	133	74.69	4.70	72	78.72	5.75	60
Minnesota	58.25	3.02	594	60.63	3.71	560	62.90	3.95	594	65.13	4.18	699	67.64	4.59	660	70.74	5.52	635	74.21	5.61	514	77.32	4.98	603	79.44	5.03	469
Nebraska	58.63	3.49	211	60.45	3.31	210	62.84	4.06	238	65.07	4.38	267	67.22	4.44	264	70.69	5.89	194	73.13	5.45	171	75.99	5.31	118	77.95	5.36	41
Ohio	58.73	3.55	211	60.56	3.27	250	62.53	3.59	300	64.91	4.46	328	66.95	5.02	311	69.61	4.74	298	73.20	5.43	247	76.34	5.43	197	78.47	5.62	124
Pennsylvania	58.83	3.42	361	60.89	3.75	438	62.94	4.59	374	64.92	4.61	477	67.94	5.51	436	71.09	6.05	477	74.13	6.29	549	77.73	5.90	545	79.34	5.03	405
Tennessee	58.05	2.79	262	59.64	3.78	398	61.87	3.93	357	63.77	4.18	396	66.01	5.19	377	68.51	5.28	322	71.80	5.68	302	74.17	5.17	232	76.84	4.84	149
Texas	59.49	3.35	346	61.07	3.40	472	63.23	4.13	518	65.43	4.55	435	68.21	4.99	453	70.86	5.21	532	74.39	5.61	576	77.43	5.73	443	79.38	5.02	304
Utah	59.17	2.83	232	61.51	3.68	274	62.95	3.50	348	65.51	4.06	351	67.32	4.27	399	70.30	4.74	352	73.13	4.89	253	76.09	5.26	129	77.47	3.94	36

WAIST GIRTH

Alabama	52.61	3.11	340	53.76	3.63	450	54.67	3.63	487	55.98	3.94	541	57.80	4.82	584	59.29	4.54	562	61.17	5.32	567	62.93	5.16	544	63.86	5.08	421
California	53.25	3.49	245	54.36	4.10	264	56.02	4.23	261	58.60	5.07	271	60.28	5.34	271	61.78	5.45	274	62.88	6.09	274	64.16	5.53	226	64.98	4.83	188
Colorado	51.32	3.20	295	52.70	3.07	320	53.86	3.48	396	55.58	4.09	392	56.77	4.39	419	58.41	4.57	369	60.61	5.03	345	62.18	4.62	265	63.52	3.97	172
District of Columbia, Maryland, and Virginia	52.65	3.56	436	53.66	3.31	522	55.15	4.13	561	56.58	4.62	556	58.04	4.92	538	59.85	5.26	478	61.97	5.34	680	63.18	5.00	641	63.45	4.57	470
Illinois	53.46	4.36	196	54.27	4.12	260	55.58	4.17	305	57.19	5.33	334	58.97	5.58	382	60.67	5.60	407	61.89	5.00	351	63.38	5.01	299	64.50	5.04	156
Iowa	52.15	2.98	445	53.79	3.50	535	55.34	4.28	492	56.70	4.30	539	58.32	4.95	542	59.79	4.70	540	61.93	4.87	323	63.01	5.38	181	63.95	5.85	134
Kansas	51.73	3.10	305	53.21	3.76	364	54.49	3.98	364	56.04	4.42	412	57.48	4.36	409	59.96	5.22	473	61.78	5.82	580	62.75	4.97	638	64.00	4.97	504
Michigan	52.26	3.29	80	53.25	4.11	100	55.70	4.59	159	56.50	4.64	176	58.27	4.36	208	59.24	4.93	219	60.59	4.16	133	61.57	3.99	72	63.98	5.17	60
Minnesota	51.51	3.20	594	53.10	3.80	560	54.60	4.27	594	56.14	4.37	699	57.70	4.97	660	59.65	5.30	635	61.25	4.89	514	62.50	4.34	603	63.66	4.64	469
Nebraska	51.81	3.41	211	52.81	3.40	210	54.42	4.09	238	55.75	4.06	267	57.34	4.42	264	59.65	5.63	194	60.84	4.76	171	62.33	4.17	118	62.61	4.14	41
Ohio	51.67	3.49	211	52.87	3.25	250	53.94	3.76	300	55.69	4.59	328	56.77	4.72	311	58.26	4.36	298	60.60	4.94	247	62.35	5.12	197	63.44	5.54	124
Pennsylvania	51.60	3.70	361	52.76	3.97	438	54.31	4.76	374	55.53	4.81	477	57.99	5.56	436	59.63	5.65	477	61.16	5.47	549	62.90	5.28	545	63.65	4.70	405
Tennessee	51.47	2.86	262	52.36	3.51	398	53.78	4.02	357	54.94	4.30	396	56.33	4.84	377	58.24	5.23	322	60.22	5.07	302	60.87	4.99	232	61.54	4.49	149
Texas	52.55	3.74	346	53.53	3.81	472	54.91	3.99	518	56.70	4.67	435	58.47	4.95	453	59.89	5.03	532	61.71	5.01	576	63.00	5.19	443	63.82	4.82	304
Utah	51.34	3.04	232	52.91	3.43	274	53.74	3.35	348	55.31	4.01	351	56.42	3.81	399	58.30	4.36	352	59.75	4.17	253	61.26	4.71	129	61.92	3.70	36

HIP GIRTH

Alabama	60
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TABLE 40.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for girls aged 6 to 14—Continued

NECK-BASE GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	28.47	1.41	340	29.07	1.40	450	29.78	1.44	487	30.39	1.50	541	31.24	1.68	584	32.12	1.86	562	33.10	1.88	567	34.22	1.89	544	34.92	1.70	421
California	28.69	1.56	245	29.28	1.59	264	30.17	1.52	261	31.11	1.74	271	32.06	1.61	271	33.06	1.91	274	34.31	2.02	274	35.50	1.81	226	36.01	1.68	188
Colorado	28.45	1.32	295	29.15	1.43	320	29.83	1.38	396	30.63	1.46	392	31.29	1.62	419	32.25	1.74	369	33.47	1.94	345	34.51	1.76	265	35.51	1.54	172
District of Columbia, Maryland, and Virginia	28.80	1.48	436	29.47	1.58	522	30.13	1.66	561	30.91	1.76	556	31.81	1.87	538	32.97	2.06	478	34.34	1.92	680	35.28	1.90	641	35.53	1.66	470
Illinois	29.73	1.61	196	30.38	1.63	260	31.03	1.63	305	31.52	1.77	334	32.53	1.87	382	33.30	1.90	407	34.10	1.79	351	34.98	1.76	299	35.85	1.89	156
Iowa	28.17	1.28	445	29.02	1.37	535	29.82	1.59	492	30.46	1.65	539	31.31	1.73	542	32.23	1.78	540	33.52	1.91	323	34.03	1.91	181	34.88	1.70	134
Kansas	28.75	1.51	305	29.41	1.59	364	30.20	1.55	364	30.96	1.79	412	31.70	1.72	409	32.77	1.92	473	33.80	1.99	580	34.45	1.90	638	35.14	1.67	504
Michigan	28.78	1.31	80	29.29	1.49	100	30.21	1.64	159	30.53	1.48	176	31.44	1.91	208	32.22	1.83	219	33.05	1.84	133	33.54	1.72	72	34.80	1.77	60
Minnesota	28.74	1.38	594	29.49	1.48	560	30.36	1.63	594	31.14	1.70	699	31.86	1.75	660	32.81	1.87	635	34.09	1.97	514	35.23	1.77	603	35.77	1.68	469
Nebraska	28.20	1.49	211	28.82	1.43	210	29.53	1.62	238	30.39	1.68	267	31.20	1.67	264	32.26	1.83	194	33.01	1.77	171	33.90	2.04	118	35.12	1.86	41
Ohio	28.45	1.46	211	29.00	1.42	250	29.58	1.40	300	30.35	1.51	328	31.04	1.76	311	31.97	1.89	298	33.21	1.88	247	34.29	2.01	197	34.85	1.79	124
Pennsylvania	28.88	2.26	361	29.64	1.71	438	30.44	1.87	374	31.00	1.89	477	31.89	2.02	436	33.04	2.17	477	34.09	2.03	549	35.27	2.05	545	35.77	1.71	405
Tennessee	28.43	1.28	262	28.98	1.55	398	29.76	1.55	357	30.60	1.59	396	31.27	1.81	377	32.11	1.75	322	33.29	1.87	302	34.12	1.68	232	34.66	1.77	149
Texas	28.34	1.40	346	28.88	1.35	472	29.60	1.51	518	30.31	1.67	435	31.11	1.68	453	31.97	1.70	532	33.04	1.82	576	33.95	1.76	443	34.50	1.79	304
Utah	28.88	1.54	232	29.16	1.50	274	30.22	1.44	348	30.98	1.63	351	31.63	1.59	399	32.56	1.73	352	33.37	1.88	253	34.13	1.72	129	34.67	1.47	36

ARMSCYE GIRTH

Alabama	26.18	1.55	340	27.15	1.65	450	28.07	1.75	487	29.16	1.86	541	30.54	2.27	584	31.88	2.25	562	33.34	2.53	567	34.81	2.48	544	36.04	2.43	421
California	27.04	1.90	245	28.31	2.03	264	29.41	2.07	261	30.89	2.33	271	32.28	2.41	271	33.83	2.44	274	34.97	2.96	274	36.25	2.55	226	36.95	2.46	188
Colorado	26.93	1.72	295	27.88	1.71	320	29.01	1.93	396	30.00	1.95	392	31.02	2.20	419	32.21	2.32	369	33.78	2.33	345	35.10	2.32	265	36.58	2.25	172
District of Columbia, Maryland, and Virginia	27.82	1.96	436	28.75	1.93	522	29.94	2.18	561	31.02	2.52	556	32.27	2.50	538	33.58	2.67	478	35.16	2.71	680	36.35	2.49	641	36.91	2.15	470
Illinois	27.47	2.03	196	28.17	1.92	260	29.40	2.06	305	30.26	2.41	334	31.62	2.38	382	33.05	2.54	407	34.29	2.44	351	35.57	2.46	299	36.90	2.20	156
Iowa	26.93	1.62	445	28.22	1.73	535	29.40	2.09	492	30.30	2.09	539	31.68	2.38	542	32.91	2.44	540	34.57	2.47	323	35.93	2.83	181	37.23	2.65	134
Kansas	26.48	1.71	305	27.69	1.94	364	28.73	1.90	364	29.79	2.27	412	31.14	2.22	409	32.67	2.44	473	34.10	2.74	580	35.17	2.47	638	36.11	2.29	504
Michigan	27.48	1.78	80	28.29	1.84	100	30.23	2.02	159	30.15	1.95	176	31.21	2.24	208	32.26	2.22	219	33.22	1.97	133	34.08	1.98	72	35.58	2.20	60
Minnesota	26.69	2.00	594	27.89	2.11	560	29.09	2.15	594	30.00	2.37	699	31.37	2.53	660	32.78	2.74	635	34.35	2.80	514	36.05	2.90	603	37.20	2.98	469
Nebraska	26.54	1.77	211	27.52	1.66	210	28.68	1.92	238	29.86	2.02	267	30.91	2.03	264	32.51	2.56	194	33.42	2.43	171	34.79	2.21	118	36.02	2.24	41
Ohio	26.63	1.81	211	27.53	1.63	250	28.59	1.87	300	29.70	2.04	328	30.74	2.25	311	31.93	2.16	298	33.72	2.49	247	35.21	2.74	197	36.11	2.60	124
Pennsylvania	26.39	1.94	361	27.42	2.06	438	28.63	2.51	374	29.49	2.40	477	31.04	2.89	436	32.36	3.07	477	33.83	3.07	549	35.39	2.98	545	36.33	2.55	405
Tennessee	26.63	1.70	262	27.29	1.89	398	28.49	1.91	357	29.48	2.07	396	30.71	2.44	377	32.05	2.45	322	33.62	2.57	302	34.58	2.26	232	35.40	2.16	149
Texas	26.66	1.74	346	27.64	1.82	472	28.78	2.04	518	29.96	2.20	435	31.36	2.26	453	32.64	2.45	532	34.14	2.33	576	35.46	2.59	443	36.27	2.41	304
Utah	27.10	1.77	232	28.26	1.91	274	28.97	1.86	348	30.20	2.02	351	31.22	2.02	399	32.56	2.24	352	33.69	2.36	253	34.93	2.45	129	35.92	1.78	36

UPPER-ARM GIRTH

Alabama	16.85	1.28	340	17.38	1.55	450	17.69	1.53	487	18.40	1.81	541	19.30	2.05	584	19.95	3.51	562	20.66	2.37	567	21.64	2.38	544	22.41	2.32	421
California	17.87	1.49	245	18.35	1.69	264	19.19	1.84	261	20.20	2.15	271	21.13	2.31	271	21.83	2.29	274	22.34	2.49	274	23.13	2.42	226	23.69	2.14	188
Colorado	17.18	1.43	295	17.74	1.51	320	18.42	1.73	396	19.15	1.88	392	19.65	2.02	419	20.40	2.17	369	21.29	2.24	345	22.29	2.27	265	23.38	2.13	172
District of Columbia, Maryland, and Virginia	17.54	1.58	436	17.99	1.66	522	18.58	1.84	561	19.26	2.11	556	20.00	2.27	538	20.68	2.23	478	21.71	2.47	680	22.50	2.41	641	22.90	2.43	470
Illinois	18.09	1.90	196	18.33	1.90	260	19.10	1.93	305	19.72	2.39	334	20.59	2.51	382	21.36	2.49	407	21.98	2.31	351	23.03	2.56	299	24.20	2.51	156
Iowa	17.18	1.35	445	17.81	1.53	535	18.60	1.90	492	19.18	1.89	539	19.96	2.19	542	20.68	2.08	540	21.70	2.20	323	22.42	2.44	181	23.14	2.41	134
Kansas	17.20	1.40	305	17.84	1.64	364	18.32	1.59	364	19.13	1.97	412	19.74	1.99	409	20.75	2.38	473	21.76	2.58	580	22.43	2.39	638	23.28	2.35	504
Michigan	17.55	1.40	80	17.89	1.66	100	19.16	2.18	159	19.48	2.14	176	20.37	2.52	208	20.95	2.38	219	21.31	2.10	133	21.81	2.17	72	23.12	2.70	60
Minnesota	17.20	1.40	594	17.95	1.73	560	18.69	1.83	594	19.36	1.93	699	20.22	2.22	660	21.17	2.44	635	21.88	2.41	514	23.06	2.44	603	23.92	2.93	469
Nebraska	17.11	1.45	211	17.57	1.56	210	18.29	1.75	238	18.99	1.97	267	19.58	1.93	264	20.63	2.47	194	21.16	2.25	171	21.97	2.15	118	22.95	1.91	41
Ohio	17.23	1.57	211	17.59	1.53	250	18.16	1.62	300	18.97	1.99	328	19.45	1.99	311	20.11	2.00	298	21.30	2.28	247	22.22	2.50	197	23.16	2.35	124
Pennsylvania	16.85	1.42	361	17.50	1.67	438	18.07	1.92	374	18.70	2.05	477	19.70	2.35	436	20.49	2.40	477	21.42	2.65	549	22.51	2.47	545	23.14	2.19	405
Tennessee	16.98	1.30	262	17.40	1.66	398	18.09	1.72	357	18.55	1.86	396	19.88	2.21	377	20.06	2.21	322	21.02	2.39	302	21.72	2.23	232	22.64	2.02	149
Texas	17.38	1.47	346	17.84	1.61	472	18.41	1.76	518	19.20	2.08	435	20.01	2.10	453	20.62	2.15	532	21.48	2.32	576	22.23	2.41	443	22.90	2.23	304
Utah	17.12	1.20	232	17.73	1.53	274	18.14	1.53	348	18.89	1.82	351	19.42	1.77	399	20.29	1.88	352	21.01	2.08	253	21.64	1.95	129	22.17	1.56	36

TOTAL POSTERIOR ARM LENGTH

Alabama	40.64	2.15	340	42.40	2.19	450	44.59	2.55	487	46.74	2.60	541	49.11	2.82	584	
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TABLE 40.—Mean, standard deviation (centimeters), and number of cases for each of 19 measurements by State and age for girls aged 6 to 14—  
Continued

THIGH GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases
Alabama	34.76	2.62	340	36.22	3.21	450	37.47	3.24	487	39.17	3.75	541	41.04	4.17	584	42.72	4.15	562	44.87	4.98	567	47.31	5.18	544	49.32	4.79	421
California	36.28	3.10	245	37.77	3.52	264	39.75	3.59	261	42.18	4.38	271	44.30	4.37	271	46.18	4.70	274	48.20	5.43	274	50.72	5.50	226	52.26	4.64	188
Colorado	34.44	2.93	295	35.97	3.00	320	37.58	3.40	396	39.34	3.88	392	40.74	4.27	419	42.70	4.52	369	44.89	4.81	345	47.60	4.95	265	49.69	4.60	172
District of Columbia, Maryland, and Vir- ginia	35.52	3.17	436	37.00	3.50	522	38.50	3.89	561	40.04	4.13	556	41.90	4.80	538	43.77	4.78	478	46.68	5.15	680	48.91	5.06	641	50.06	4.64	470
Illinois	36.72	3.82	196	37.76	3.66	260	39.34	4.01	305	40.64	4.77	334	42.84	4.88	382	44.82	4.89	407	46.37	4.91	351	48.80	5.31	299	51.13	4.75	156
Iowa	34.86	2.80	445	36.56	3.21	535	38.42	3.96	492	40.04	3.98	539	41.88	4.70	542	43.66	4.43	540	46.01	4.73	323	47.66	5.56	181	49.80	5.45	134
Kansas	34.73	2.83	305	36.37	3.49	364	37.98	3.36	364	39.72	4.05	412	41.41	4.10	409	43.95	4.68	473	46.38	5.17	580	48.14	5.03	638	50.36	4.75	504
Michigan	35.19	3.38	80	36.59	3.27	100	39.23	4.42	159	40.13	4.18	176	41.99	4.89	208	43.16	4.77	219	44.25	4.34	133	46.32	4.32	72	48.58	5.90	60
Minnesota	34.65	3.06	594	36.68	4.03	560	38.22	3.83	594	40.16	4.15	699	41.90	4.40	660	44.11	5.04	635	46.47	5.24	514	49.39	5.00	603	51.62	5.04	469
Nebraska	34.80	3.05	211	36.00	3.21	210	37.89	3.76	238	39.64	4.01	267	41.23	4.20	264	43.75	5.29	194	45.17	4.78	171	47.16	4.41	118	49.88	4.72	41
Ohio	34.82	3.34	211	36.02	3.15	250	37.41	3.48	300	39.28	4.15	328	40.55	4.15	311	42.26	4.31	298	45.22	4.77	247	47.59	5.29	197	49.57	4.97	124
Pennsylvania	34.86	3.25	361	36.62	3.88	438	38.14	4.19	374	39.74	4.55	477	42.01	4.95	436	43.99	5.28	477	46.08	5.44	549	48.63	5.32	545	49.98	4.52	405
Tennessee	34.58	2.86	262	35.60	3.41	398	37.36	3.63	357	38.74	3.93	396	40.58	4.49	377	42.42	4.66	322	44.71	4.76	302	46.18	4.73	232	48.53	4.41	149
Texas	35.69	3.22	346	37.02	3.44	472	38.55	3.80	518	40.37	4.22	435	42.55	4.34	453	44.27	4.54	532	46.55	4.68	576	48.57	5.19	443	50.31	4.55	304
Utah	34.29	2.67	232	36.06	3.30	274	37.14	3.23	348	38.89	3.84	351	40.44	3.84	399	42.57	4.34	352	44.54	4.52	253	45.95	4.39	129	47.44	3.71	36

MAXIMUM CALF GIRTH

Alabama	23.58	1.60	340	24.30	1.63	450	25.07	1.75	487	26.01	2.00	541	27.11	2.14	584	28.06	2.19	562	29.28	2.58	567	30.55	2.61	544	31.40	2.43	421
California	24.20	1.67	245	25.16	2.03	264	26.20	2.00	261	27.37	2.19	271	28.69	2.27	271	29.61	2.34	274	30.51	2.61	274	31.50	2.59	226	32.23	2.47	188
Colorado	23.39	1.68	295	24.31	1.54	320	25.24	1.82	396	26.16	1.94	392	27.01	2.22	419	28.07	2.38	369	29.39	2.39	345	30.58	2.47	265	31.55	2.37	172
District of Columbia, Maryland, and Vir- ginia	23.93	1.66	436	24.73	1.81	522	25.65	1.91	561	26.52	2.13	556	27.56	2.29	538	28.62	2.40	478	30.19	2.60	680	31.19	2.41	641	31.70	2.35	470
Illinois	24.48	1.94	196	25.05	1.98	260	25.96	1.99	305	26.76	2.26	334	27.91	2.47	382	28.99	2.42	407	29.94	2.54	351	31.38	2.64	299	32.27	2.35	156
Iowa	23.41	1.45	445	24.35	1.62	535	25.44	1.93	492	26.34	2.12	539	27.31	2.24	542	28.45	2.15	540	29.79	2.34	323	30.70	2.77	181	31.75	2.45	134
Kansas	23.60	2.43	305	24.48	1.89	364	25.42	1.87	364	26.41	2.02	412	27.39	2.07	409	28.82	2.39	473	30.11	2.63	580	31.06	2.47	638	32.11	2.53	504
Michigan	23.68	1.81	80	24.71	1.77	100	26.06	2.08	159	26.48	2.20	176	27.44	2.47	208	28.50	2.54	219	29.03	2.24	133	29.90	2.20	72	31.43	2.53	60
Minnesota	23.32	1.87	594	24.42	1.86	560	25.39	1.91	594	26.41	2.05	699	27.44	2.31	660	28.77	2.54	635	30.04	2.69	514	31.39	2.46	603	32.54	2.48	469
Nebraska	23.56	1.74	211	24.34	1.67	210	25.28	1.81	238	26.38	2.05	267	27.21	2.19	264	28.63	2.60	194	29.57	2.36	171	30.63	2.49	118	31.76	2.06	41
Ohio	23.68	1.83	211	24.49	1.70	250	25.28	1.69	300	26.35	2.02	328	27.19	2.28	311	28.25	2.23	298	29.74	2.43	247	30.99	2.68	197	31.93	2.34	124
Pennsylvania	23.48	1.75	361	24.47	1.82	438	25.32	2.09	374	26.21	2.12	477	27.36	2.41	436	28.61	2.65	477	29.69	2.67	549	31.28	2.62	545	31.94	2.31	405
Tennessee	23.48	1.58	262	24.20	1.87	398	25.12	1.93	357	25.99	2.05	396	27.06	2.33	377	28.22	2.31	322	29.54	2.36	302	30.47	2.36	232	31.34	2.02	149
Texas	23.88	1.66	346	24.71	1.85	472	25.47	1.87	518	26.49	2.20	435	27.73	2.23	453	28.70	2.28	532	30.05	2.38	576	31.11	2.50	443	31.86	2.32	304
Utah	23.28	1.50	232	24.39	1.83	274	25.08	1.81	348	26.05	1.97	351	26.87	1.92	399	27.95	2.10	352	29.26	2.30	253	30.05	2.25	129	30.67	1.96	36

KNEE GIRTH

Alabama	24.76	1.46	340	25.72	1.59	450	26.55	1.72	487	27.71	1.88	541	28.89	2.10	584	30.10	2.18	562	31.30	2.39	567	32.31	2.36	544	33.04	2.21	421
California	25.19	1.64	245	26.09	1.94	264	27.43	1.79	261	28.80	2.18	271	30.09	2.19	271	31.17	2.28	274	32.32	2.45	274	33.51	2.33	226	33.87	2.11	188
Colorado	24.64	1.68	295	25.61	1.69	320	26.67	1.80	396	27.87	2.05	392	28.78	2.22	419	29.87	2.32	369	30.97	2.26	345	31.97	2.18	265	32.69	2.16	172
District of Columbia, Maryland, and Vir- ginia	25.16	1.69	436	26.02	1.80	522	27.05	1.89	561	28.05	2.13	556	29.28	2.33	538	30.51	2.36	478	32.22	2.51	680	33.22	2.41	641	33.60	2.34	470
Illinois	25.53	2.04	196	26.40	1.87	260	27.51	1.93	305	28.26	2.26	334	29.58	2.27	382	30.88	2.31	407	31.59	2.16	351	32.78	2.45	299	33.68	2.08	156
Iowa	24.40	2.01	445	25.35	1.53	535	26.59	1.94	492	27.51	2.04	539	28.68	2.19	542	29.75	2.11	540	31.17	2.11	323	31.81	2.30	181	32.73	2.32	134
Kansas	24.78	1.54	305	25.95	1.90	364	26.89	1.69	364	28.09	2.04	412	29.60	2.11	409	30.64	2.34	473	31.92	2.54	580	32.70	2.29	638	33.43	2.35	504
Michigan	24.79	2.04	80	25.84	1.84	100	27.16	2.17	159	27.96	2.23	176	29.09	2.52	208	30.14	2.69	219	30.69	2.33	133	31.14	2.16	72	32.37	2.33	60
Minnesota	24.50	1.62	594	25.79	1.84	560	26.86	1.92	594	28.00	2.14	699	29.06	2.26	660	30.54	2.43	635	31.77	2.49	514	32.91	2.38	603	33.78	2.30	469
Nebraska	24.66	1.68	211	25.62	1.69	210	26.65	1.86	238	27.85	1.99	267	28.78	2.09	264	30.30	2.51	194	31.29	2.31	171	32.12	2.24	118	33.10	2.22	41
Ohio	24.62	1.79	211	25.42	1.55	250	26.36	1.71	300	27.50	1.94	328	28.50	2.20	311	29.44	2.14	298	31.00	2.17	247	31.97	2.22	197	32.85	2.26	124



TABLE 42.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 7

Measurement	Alabama (436 boys and 450 girls)							California (234 boys and 264 girls)							Colorado (298 boys and 320 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height		0.681 <sup>2</sup>	0.919	0.549	0.549	0.842	0.638		0.748 <sup>2</sup>	0.937	0.572	0.651	0.884	0.685		0.727	0.927	0.626	0.682	0.856	0.686
Weight	0.613		.775	.820	.903	.696	.820	0.759		.800	.779	.914	.730	.827	0.727		.838	.835	.923	.776	.806
Stature	<sup>2</sup> .896	.706		.594	.642	.833	.783	<sup>2</sup> .922	.800		.583	.699	.874	.799	<sup>2</sup> .909	.775		.835	.651	.736	.852
Chest girth at armseye	.442	.838	.524		.742	.609	.650	.619	.861	.614		.700	.582	.671	.538	.845	.573		.781	.679	.669
Hip girth	.510	.927	.613	.797		.606	.748	.682	.945	.718	.820		.619	.762	.615	.930	.653	.791		.683	.762
Total posterior arm length	.823	.655	.824	.530	.592		.631	.865	.727	.856	.627	.643		.663	.854	.737	.846	.599	.626		.671
Vertical trunk girth	.595	.829	.764	.660	.782	.630		.704	.900	.811	.775	.861	.668		.623	.799	.739	.650	.737	.628	
	District of Columbia, Maryland, and Virginia (502 boys and 522 girls)							Illinois (270 boys and 260 girls)							Iowa (429 boys and 535 girls)						
Hip height		0.737 <sup>2</sup>	0.914	0.572	0.590	0.869	0.678		0.730 <sup>2</sup>	0.919	0.588	0.639	0.855	0.724		0.647 <sup>2</sup>	0.895	0.540	0.538	0.842	0.576
Weight	0.683		.797	.851	.905	.749	.869	0.747		.775	.854	.922	.749	.857	0.635		.760	.855	.916	.696	.834
Stature	<sup>2</sup> .913	.736		.620	.662	.867	.802	<sup>2</sup> .925	.793		.622	.680	.863	.834	<sup>2</sup> .896	.719		.820	.620	.641	.815
Chest girth at armseye	.550	.812	.574		.806	.616	.743	.619	.905	.653		.818	.661	.731	.458	.820	.519		.789	.622	.729
Hip girth	.598	.918	.651	.817		.617	.895	.660	.946	.694	.858		.682	.801	.514	.917	.595	.799		.398	.773
Total posterior arm length	.841	.684	.844	.581	.608		.687	.883	.763	.884	.656	.692		.728	.854	.684	.845	.558	.576		.603
Vertical trunk girth	.639	.810	.767	.675	.789	.663		.717	.880	.832	.766	.828	.724		.561	.802	.740	.680	.750	.627	
	Kansas (320 boys and 364 girls)							Michigan (248 boys and 100 girls)							Minnesota (559 boys and 560 girls)						
Hip height		0.697 <sup>2</sup>	0.910	0.587	0.601	0.870	0.621		0.677 <sup>2</sup>	0.925	0.544	0.518	0.845	0.589		0.639 <sup>2</sup>	0.888	0.430	0.539	0.792	0.575
Weight	0.685		.790	.832	.920	.715	.836	0.775		.757	.831	.898	.695	.810	0.694		.760	.785	.920	.645	.802
Stature	<sup>2</sup> .920	.774		.643	.690	.870	.779	<sup>2</sup> .923	.807		.592	.619	.832	.738	<sup>2</sup> .898	.764		.537	.644	.785	.727
Chest girth at armseye	.555	.840	.595		.752	.628	.732	.601	.870	.631		.757	.597	.693	.518	.842	.596		.766	.490	.670
Hip girth	.574	.924	.661	.812		.616	.774	.651	.895	.709	.813		.576	.750	.624	.930	.681	.813		.569	.776
Total posterior arm length	.841	.691	.834	.559	.597		.620	.897	.795	.886	.662	.703		.606	.826	.699	.837	.565	.626		.584
Vertical trunk girth	.658	.857	.796	.735	.791	.632		.639	.791	.774	.684	.767	.679		.646	.836	.765	.724	.798	.644	
	Nebraska (221 boys and 210 girls)							Ohio (392 boys and 250 girls)							Pennsylvania (290 boys and 438 girls)						
Hip height		0.743 <sup>2</sup>	0.927	0.574	0.623	0.851	0.693		0.719 <sup>2</sup>	0.927	0.546	0.588	0.862	0.639		0.720 <sup>2</sup>	0.883	0.479	0.570	0.798	0.563
Weight	0.662		.802	.837	.939	.722	.852	0.666		.777	.802	.904	.718	.828	0.671		.811	.752	.865	.735	.794
Stature	<sup>2</sup> .898	.759		.600	.692	.824	.810	<sup>2</sup> .916	.701		.593	.664	.860	.750	<sup>2</sup> .909	.754		.566	.657	.847	.735
Chest girth at armseye	.521	.859	.575		.802	.626	.682	.500	.814	.489		.789	.592	.696	.542	.847	.595		.737	.595	.702
Hip girth	.557	.941	.650	.825		.618	.780	.542	.922	.577	.765		.623	.760	.591	.942	.652	.815		.655	.728
Total posterior arm length	.845	.676	.854	.526	.595		.667	.867	.691	.858	.540	.569		.620	.830	.731	.855	.620	.665		.652
Vertical trunk girth	.619	.823	.777	.678	.762	.634		.623	.815	.739	.651	.788	.636		.685	.803	.770	.723	.762	.688	
	Tennessee (220 boys and 348 girls)							Texas (434 boys and 472 girls)							Utah (245 boys and 274 girls)						
Hip height		0.758 <sup>2</sup>	0.937	0.618	0.702	0.891	0.678		0.696 <sup>2</sup>	0.916	0.572	0.617	0.844	0.653		0.695 <sup>2</sup>	0.912	0.591	0.595	0.830	0.661
Weight	0.735		.798	.821	.928	.730	.837	0.835		.749	.887	.953	.670	.834	0.719		.795	.826	.908	.670	.854
Stature	<sup>2</sup> .928	.813		.661	.737	.878	.777	<sup>2</sup> .915	.766		.609	.671	.826	.782	<sup>2</sup> .929	.788		.652	.687	.806	.790
Chest girth at armseye	.612	.861	.670		.811	.630	.773	.547	.865	.569		.863	.572	.704	.598	.876	.644		.754	.599	.745
Hip girth	.658	.927	.719	.808		.666	.829	.635	.941	.669	.835		.598	.787	.643	.938	.699	.847		.602	.812
Total posterior arm length	.880	.736	.881	.625	.660		.628	.851	.695	.858	.556	.610		.620	.889	.714	.878	.624	.644		.631
Vertical trunk girth	.733	.854	.840	.737	.789	.713		.685	.849	.806	.705	.792	.695		.667	.860	.789	.757	.820	.668	

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).



TABLE 43.—Intercorrelations<sup>1</sup> of 7 measurements for each State for boys and girls aged 8

Measurement	Alabama (483 boys and 487 girls)							California (264 boys and 261 girls)							Colorado (362 boys and 396 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height.....	0.712	0.701	0.927	0.543	0.589	0.848	0.660	0.681	0.682	0.943	0.538	0.577	0.888	0.706	0.703	0.756	0.929	0.610	0.639	0.862	0.656
Weight.....			.782	.822	.918	.727	.848			.738	.854	.950	.719	.877		.822	.843	.921	.736	.800	
Stature.....				.572	.673	.844	.794			.758	.561	.633	.872	.800		.750	.652	.705	.860	.768	
Chest girth at armsye.....					.783	.587	.693			.552	.872	.579	.580	.732		.561	.869	.598	.804	.622	.684
Hip girth.....						.634	.787			.585	.938	.648	.826	.824		.619	.942	.656	.817	.628	.775
Total posterior arm length.....							.675			.855	.662	.857	.526	.547		.879	.735	.839	.636	.651	.623
Vertical trunk girth.....										.675	.879	.803	.763	.831		.600	.807	.750	.699	.752	.605
	District of Columbia, Maryland, and Virginia (535 boys and 561 girls)							Illinois (348 boys and 305 girls)							Iowa (544 boys and 492 girls)						
Hip height.....	0.730	0.708	0.924	0.535	0.608	0.878	0.678	0.700	0.689	0.926	0.575	0.609	0.857	0.666	0.707	0.660	0.913	0.553	0.578	0.860	0.649
Weight.....			.796	.849	.940	.748	.877			.729	.854	.914	.688	.814		.748	.861	.923	.678	.852	
Stature.....				.616	.705	.869	.805			.752	.620	.666	.855	.777		.765	.608	.663	.847	.788	
Chest girth at armsye.....					.840	.616	.761			.502	.865	.536	.860	.611		.567	.873	.607	.828	.593	.735
Hip girth.....						.668	.821			.604	.939	.650	.831	.626		.627	.936	.665	.853	.624	.807
Total posterior arm length.....							.699			.875	.712	.885	.546	.634		.856	.698	.832	.617	.633	.646
Vertical trunk girth.....										.712	.869	.819	.735	.832		.689	.875	.808	.765	.813	.662
	Kansas (346 boys and 364 girls)							Michigan (345 boys and 159 girls)							Minnesota (577 boys and 594 girls)						
Hip height.....	0.642	0.649	0.909	0.469	0.542	0.867	0.618	0.671	0.728	0.944	0.608	0.615	0.863	0.683	0.675	0.711	0.918	0.510	0.603	0.862	0.650
Weight.....			.752	.850	.935	.702	.859			.783	.885	.948	.746	.865		.770	.816	.907	.697	.820	
Stature.....				.568	.650	.854	.777			.732	.649	.674	.852	.789		.785	.567	.663	.842	.766	
Chest girth at armsye.....					.827	.578	.754			.574	.878	.627	.852	.669		.540	.871	.604	.770	.536	.690
Hip girth.....						.825	.821			.577	.979	.627	.881	.664		.572	.919	.639	.812	.597	.766
Total posterior arm length.....							.657			.888	.739	.881	.666	.665		.841	.678	.840	.556	.585	.654
Vertical trunk girth.....										.638	.870	.752	.765	.845		.639	.846	.763	.737	.786	.629
	Nebraska (225 boys and 238 girls)							Ohio (488 boys and 300 girls)							Pennsylvania (299 boys and 374 girls)						
Hip height.....	0.665	0.738	0.917	0.588	0.663	0.866	0.703	0.641	0.711	0.923	0.612	0.641	0.874	0.670	0.704	0.651	0.897	0.483	0.508	0.769	0.600
Weight.....			.801	.871	.945	.731	.861			.782	.837	.929	.717	.836		.759	.797	.902	.716	.818	
Stature.....				.623	.737	.842	.824			.699	.670	.712	.875	.789		.785	.546	.627	.830	.732	
Chest girth at armsye.....					.843	.648	.718			.537	.859	.560	.797	.637		.611	.886	.653	.762	.591	.682
Hip girth.....						.668	.824			.546	.928	.611	.829	.640		.578	.945	.706	.839	.644	.793
Total posterior arm length.....							.664			.876	.634	.857	.567	.558		.868	.748	.854	.651	.682	.659
Vertical trunk girth.....										.593	.824	.732	.715	.790		.689	.854	.810	.774	.808	.687
	Tennessee (354 boys and 357 girls)							Texas (415 boys and 518 girls)							Utah (308 boys and 348 girls)						
Hip height.....	0.675	0.760	0.934	0.658	0.669	0.891	0.705	0.703	0.740	0.922	0.610	0.657	0.855	0.667	0.715	0.741	0.924	0.631	0.630	0.870	0.667
Weight.....			.815	.867	.947	.734	.864			.781	.850	.943	.693	.862		.835	.869	.926	.778	.870	
Stature.....				.703	.728	.869	.826			.759	.630	.679	.833	.800		.767	.692	.730	.860	.798	
Chest girth at armsye.....					.822	.678	.762			.802	.534	.817	.605	.738		.871	.631	.816	.681	.763	
Hip girth.....						.660	.826			.630	.944	.668	.762	.610		.601	.912	.648	.843	.668	.838
Total posterior arm length.....							.673			.844	.690	.852	.536	.619		.892	.712	.855	.629	.610	.682
Vertical trunk girth.....										.666	.867	.793	.682	.808		.729	.844	.812	.752	.783	.688

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 44.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 9

Measurement	Alabama (495 boys and 541 girls)							California (296 boys and 271 girls)							Colorado (366 boys and 392 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height	0.695	0.683	0.916	0.538	0.587	0.867	0.659	0.724	0.707	0.930	0.526	0.609	0.878	0.687	0.646	0.702	0.926	0.619	0.619	0.870	0.616
Weight	<sup>2</sup> 0.909	.760	.762	.824	.925	.686	.858	<sup>2</sup> 0.938	.766	.766	.849	.926	.718	.877	<sup>2</sup> 0.892	.727	.766	.882	.943	.691	.825
Stature	.557	.872	.591	.591	.659	.842	.800	<sup>2</sup> 0.938	.766	.766	.849	.926	.718	.877	<sup>2</sup> 0.892	.727	.766	.882	.943	.691	.825
Chest girth at armscye	.616	.946	.683	.832	.764	.585	.698	.604	.890	.609	.557	.653	.861	.795	.505	.896	.570	.661	.684	.852	.749
Hip girth	.865	.698	.845	.590	.621	.610	.810	.638	.957	.657	.861	.621	.819	.558	.951	.628	.864	.844	.628	.787	
Total posterior arm length	.651	.866	.796	.716	.820	.642	.649	.885	.713	.883	.599	.618	.681	.873	.673	.857	.546	.595	.628	.607	
Vertical trunk girth								.716	.915	.811	.787	.854	.695	.568	.845	.743	.770	.793	.592		
District of Columbia, Maryland, and Virginia (608 boys and 556 girls)																					
							Illinois (353 boys and 334 girls)							Iowa (483 boys and 539 girls)							
Hip height	0.709	0.717	0.914	0.574	0.610	0.881	0.693	0.701	0.722	0.932	0.566	0.630	0.812	0.718	0.676	0.620	0.927	0.511	0.548	0.849	0.618
Weight	<sup>2</sup> 0.929	.775	.765	.861	.930	.740	.840	<sup>2</sup> 0.919	.727	.750	.849	.938	.661	.851	<sup>2</sup> 0.928	.750	.730	.850	.939	.670	.858
Stature	.529	.884	.552	.574	.650	.829	.797	<sup>2</sup> 0.906	.727	.739	.848	.940	.647	.866	<sup>2</sup> 0.928	.750	.730	.850	.939	.670	.858
Chest girth at armscye	.573	.950	.639	.841	.813	.513	.733	.548	.851	.592	.549	.658	.798	.824	.571	.874	.632	.801	.555	.705	
Hip girth	.875	.729	.871	.616	.645	.561	.793	.558	.909	.615	.869	.626	.509	.717	.586	.878	.624	.809	.634	.746	
Total posterior arm length	.636	.874	.768	.756	.835	.670	.599	.847	.713	.858	.604	.652	.583	.846	.721	.833	.612	.660	.618	.644	
Vertical trunk girth								.627	.851	.762	.767	.857	.694	.718	.875	.813	.763	.820	.698		
							Kansas (332 boys and 412 girls)							Michigan (360 boys and 176 girls)							
Hip height	0.672	0.667	0.920	0.537	0.584	0.844	0.676	0.678	0.644	0.922	0.470	0.533	0.873	0.603	0.702	0.714	0.923	0.586	0.622	0.871	0.683
Weight	<sup>2</sup> 0.936	.736	.737	.859	.947	.627	.849	<sup>2</sup> 0.906	.727	.739	.848	.940	.647	.866	<sup>2</sup> 0.928	.750	.790	.846	.930	.734	.865
Stature	.529	.884	.552	.574	.650	.829	.797	<sup>2</sup> 0.906	.727	.739	.848	.940	.647	.866	<sup>2</sup> 0.928	.750	.790	.846	.930	.734	.865
Chest girth at armscye	.573	.950	.639	.841	.813	.513	.733	.548	.851	.592	.549	.658	.798	.824	.571	.874	.632	.801	.555	.705	
Hip girth	.875	.729	.871	.616	.645	.561	.793	.558	.909	.615	.869	.626	.509	.717	.586	.878	.624	.809	.634	.746	
Total posterior arm length	.636	.874	.768	.756	.835	.670	.599	.847	.713	.858	.604	.652	.583	.846	.721	.833	.612	.660	.618	.644	
Vertical trunk girth								.627	.851	.762	.767	.857	.694	.718	.875	.813	.763	.820	.698		
							Minnesota (687 boys and 699 girls)							Nebraska (232 boys and 267 girls)							
Hip height	0.626	0.713	0.936	0.527	0.648	0.881	0.734	0.686	0.729	0.931	0.623	0.635	0.892	0.683	0.576	0.695	0.898	0.543	0.553	0.778	0.617
Weight	<sup>2</sup> 0.900	.737	.752	.851	.950	.709	.885	<sup>2</sup> 0.927	.734	.792	.855	.935	.756	.865	<sup>2</sup> 0.891	.693	.802	.864	.918	.776	.840
Stature	.585	.910	.666	.552	.679	.857	.817	<sup>2</sup> 0.927	.734	.792	.855	.935	.756	.865	<sup>2</sup> 0.891	.693	.802	.864	.918	.776	.840
Chest girth at armscye	.523	.951	.630	.860	.824	.574	.749	.575	.898	.613	.549	.658	.798	.824	.571	.874	.632	.801	.555	.749	
Hip girth	.859	.666	.848	.621	.573	.643	.849	.596	.951	.656	.870	.674	.676	.823	.484	.956	.611	.865	.698	.779	
Total posterior arm length	.627	.884	.794	.819	.823	.655	.710	.868	.699	.869	.643	.615	.705	.830	.667	.862	.541	.601	.618	.711	
Vertical trunk girth								.676	.883	.788	.797	.854	.667	.573	.851	.727	.769	.822	.616		
							Ohio (576 boys and 328 girls)							Pennsylvania (316 boys and 477 girls)							
Hip height	0.661	0.711	0.931	0.569	0.631	0.883	0.693	0.661	0.729	0.931	0.623	0.635	0.892	0.683	0.576	0.695	0.898	0.543	0.553	0.778	0.617
Weight	<sup>2</sup> 0.918	.698	.774	.856	.932	.738	.846	<sup>2</sup> 0.919	.753	.744	.896	.941	.667	.877	<sup>2</sup> 0.930	.753	.780	.855	.920	.723	.846
Stature	.524	.863	.543	.618	.698	.868	.819	<sup>2</sup> 0.919	.753	.744	.896	.941	.667	.877	<sup>2</sup> 0.930	.753	.780	.855	.920	.723	.846
Chest girth at armscye	.551	.943	.603	.818	.805	.643	.747	.590	.906	.610	.604	.664	.822	.801	.554	.852	.552	.628	.688	.857	
Hip girth	.869	.650	.851	.556	.570	.653	.814	.650	.955	.675	.868	.674	.665	.816	.616	.938	.647	.825	.630	.814	
Total posterior arm length	.675	.844	.776	.730	.800	.641	.688	.857	.678	.845	.595	.617	.665	.851	.692	.890	.576	.606	.637	.637	
Vertical trunk girth								.668	.886	.806	.770	.836	.666	.707	.876	.799	.735	.826	.680		
							Tennessee (343 boys and 396 girls)							Texas (431 boys and 435 girls)							
Hip height	0.647	0.711	0.931	0.569	0.631	0.883	0.693	0.661	0.729	0.931	0.623	0.635	0.892	0.683	0.576	0.695	0.898	0.543	0.553	0.778	0.617
Weight	<sup>2</sup> 0.918	.698	.774	.856	.932	.738	.846	<sup>2</sup> 0.919	.753	.744	.896	.941	.667	.877	<sup>2</sup> 0.930	.753	.780	.855	.920	.723	.846
Stature	.524	.863	.543	.618	.698	.868	.819	<sup>2</sup> 0.919	.753	.744	.896	.941	.667	.877	<sup>2</sup> 0.930	.753	.780	.855	.920	.723	.846
Chest girth at armscye	.551	.943	.603	.818	.805	.643	.747	.590	.906	.610	.604	.664	.822	.801	.554	.852	.552	.628	.688	.857	
Hip girth	.869	.650	.851	.556	.570	.653	.814	.650	.955	.675	.868	.674	.665	.816	.616	.938	.647	.825	.630	.814	
Total posterior arm length	.675	.844	.776	.730	.800	.641	.688	.857	.678	.845	.595	.617	.665	.851	.692	.890	.576	.606	.637	.637	
Vertical trunk girth								.668	.886	.806	.770	.836	.666	.707	.876	.799	.735	.826	.680		
							Utah (364 boys and 351 girls)														

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30.)

TABLE 45.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 10

Measurement	Alabama (548 boys and 584 girls)							California (274 boys and 271 girls)							Colorado (399 boys and 419 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height	0.692	0.735	0.927	0.615	0.644	0.838	0.703	0.639	0.706	0.940	0.593	0.614	0.900	0.723	0.716	0.723	0.920	0.602	0.619	0.868	0.668
Weight	<sup>2</sup> .921	.731	.787	.873	.938	.729	.867	.688	.762	.894	.963	.750	.901	.909	.766	.787	.870	.943	.724	.857	.857
Stature	.549	.885	.577	.662	.707	.830	.815	.543	.883	.537	.632	.664	.885	.819	.909	.766	.633	.688	.852	.791	.791
Chest girth at armscye	.623	.958	.660	.848	.826	.629	.758	.557	.952	.594	.871	.866	.686	.794	.599	.914	.642	.816	.627	.741	.741
Hip girth	.872	.709	.864	.602	.650	.626	.823	.856	.667	.869	.551	.584	.665	.848	.638	.955	.676	.875	.637	.813	.813
Total posterior arm length	.691	.878	.831	.745	.838	.730	.682	.676	.876	.802	.755	.831	.709	.752	.874	.726	.856	.634	.649	.674	.674
Vertical trunk girth															.631	.853	.785	.776	.809	.627	.627
	District of Columbia, Maryland, and Virginia (604 boys and 538 girls)							Illinois (397 boys and 382 girls)							Iowa (554 boys and 542 girls)						
Hip height	0.695	0.672	0.912	0.528	0.603	0.863	0.660	0.649	0.715	0.925	0.582	0.623	0.863	0.700	0.644	0.683	0.925	0.582	0.600	0.884	0.662
Weight	<sup>2</sup> .923	.760	.751	.879	.948	.720	.867	.778	.770	.878	.948	.732	.880	.880	.723	.786	.892	.953	.706	.866	.866
Stature	.612	.907	.655	.599	.695	.870	.791	.609	.668	.609	.668	.858	.817	.915	.907	.766	.676	.711	.876	.794	.794
Chest girth at armscye	.626	.950	.681	.880	.847	.598	.762	.502	.912	.551	.860	.620	.782	.535	.907	.597	.872	.852	.636	.764	.764
Hip girth	.872	.724	.879	.658	.660	.664	.837	.883	.720	.898	.590	.655	.704	.827	.555	.955	.633	.872	.632	.826	.826
Total posterior arm length	.691	.877	.806	.794	.839	.699	.691	.677	.911	.792	.812	.884	.713	.704	.875	.694	.875	.593	.608	.655	.655
Vertical trunk girth															.644	.881	.796	.799	.836	.692	.692
	Kansas (359 boys and 409 girls)							Michigan (465 boys and 208 girls)							Minnesota (617 boys and 660 girls)						
Hip height	0.699	0.730	0.926	0.553	0.627	0.878	0.690	0.696	0.686	0.929	0.547	0.595	0.865	0.677	0.655	0.703	0.921	0.574	0.616	0.873	0.667
Weight	<sup>2</sup> .923	.767	.799	.851	.951	.752	.867	.778	.778	.881	.947	.714	.883	.883	.717	.768	.874	.942	.728	.866	.866
Stature	.600	.892	.636	.613	.693	.873	.823	.609	.665	.619	.686	.858	.796	.899	.901	.768	.628	.675	.876	.786	.786
Chest girth at armscye	.618	.955	.676	.844	.824	.625	.770	.601	.909	.667	.851	.629	.789	.550	.901	.591	.825	.628	.735	.735	.735
Hip girth	.851	.740	.875	.642	.672	.661	.811	.854	.776	.858	.736	.713	.684	.813	.646	.818	.545	.562	.652	.837	.837
Total posterior arm length	.692	.891	.819	.798	.844	.742	.691	.698	.916	.823	.829	.869	.757	.684	.658	.873	.783	.769	.839	.625	.625
Vertical trunk girth															.658	.873	.783	.769	.839	.625	.625
	Nebraska (247 boys and 264 girls)							Ohio (581 boys and 311 girls)							Pennsylvania (345 boys and 436 girls)						
Hip height	0.656	0.636	0.935	0.457	0.512	0.873	0.616	0.739	0.707	0.934	0.601	0.621	0.884	0.658	0.616	0.648	0.905	0.472	0.531	0.751	0.639
Weight	<sup>2</sup> .913	.727	.740	.867	.948	.695	.890	.779	.779	.880	.962	.708	.861	.861	.699	.730	.873	.939	.710	.858	.858
Stature	.545	.895	.580	.545	.620	.862	.774	.606	.884	.606	.872	.659	.770	.551	.699	.601	.554	.622	.819	.759	.759
Chest girth at armscye	.557	.954	.619	.871	.833	.559	.744	.606	.884	.606	.852	.652	.844	.551	.948	.618	.868	.864	.604	.770	.770
Hip girth	.887	.696	.877	.591	.617	.599	.838	.899	.722	.884	.610	.643	.657	.844	.551	.948	.618	.868	.659	.830	.830
Total posterior arm length	.691	.883	.819	.777	.827	.718	.655	.735	.896	.833	.795	.860	.720	.657	.674	.866	.789	.805	.819	.722	.722
Vertical trunk girth															.674	.866	.789	.805	.819	.722	.722
	Tennessee (381 boys and 377 girls)							Texas (434 boys and 453 girls)							Utah (441 boys and 399 girls)						
Hip height	0.716	0.655	0.929	0.514	0.551	0.874	0.668	0.620	0.658	0.918	0.584	0.575	0.841	0.653	0.646	0.707	0.932	0.604	0.624	0.882	0.716
Weight	<sup>2</sup> .933	.787	.723	.857	.933	.692	.869	.681	.714	.892	.950	.643	.884	.884	.726	.785	.883	.944	.733	.877	.877
Stature	.612	.910	.675	.569	.623	.842	.795	.681	.681	.596	.623	.819	.788	.913	.726	.785	.653	.690	.867	.827	.827
Chest girth at armscye	.654	.959	.722	.877	.824	.593	.749	.606	.884	.596	.879	.862	.592	.527	.886	.595	.850	.653	.785	.785	.785
Hip girth	.893	.736	.894	.661	.676	.593	.817	.863	.614	.854	.516	.533	.651	.840	.562	.936	.641	.851	.652	.835	.835
Total posterior arm length	.699	.895	.823	.814	.861	.710	.673	.612	.876	.767	.767	.838	.642	.651	.630	.832	.783	.751	.785	.684	.684
Vertical trunk girth															.630	.832	.783	.751	.785	.684	.684

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 46.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 11

Measurement	Alabama (510 boys and 562 girls)							California (283 boys and 274 girls)							Colorado (372 boys and 369 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height.....		0.633	<sup>2</sup> 0.929	0.555	0.560	0.875	0.674		0.664	<sup>2</sup> 0.928	0.556	0.547	0.880	0.676		0.669	<sup>2</sup> 0.899	0.565	0.584	0.859	0.607
Weight.....	0.709		.741	.897	.946	.695	.894	.680		.727	.903	.948	.689	.876	0.669	0.690	.787	.872	.941	.704	.839
Stature.....	<sup>2</sup> .926	.785		.635	.663	.862	.808	<sup>2</sup> .931	.730		.597	.601	.869	.797	<sup>2</sup> .903	.750		.617	.674	.841	.785
Chest girth at armseye.....	.626	.914	.686		.847	.652	.801	.564	.899	.585		.887	.572	.784	.525	.890	.596		.835	.613	.740
Hip girth.....	.633	.959	.722	.880		.633	.850	.604	.962	.652	.869		.577	.825	.623	.961	.703	.876		.621	.800
Total posterior arm length.....	.879	.713	.879	.642	.651		.701	.894	.719	.900	.593	.640		.658	.873	.687	.863	.563	.637		.623
Vertical trunk girth.....	.734	.879	.860	.784	.847	.741		.699	.913	.815	.805	.876	.739		.630	.862	.809	.773	.842	.652	
	District of Columbia, Maryland, and Virginia (582 boys and 478 girls)							Illinois (409 boys and 407 girls)							Iowa (501 boys and 540 girls)						
Hip height.....		0.712	<sup>2</sup> 0.924	0.601	0.613	0.877	0.694		0.734	<sup>2</sup> 0.936	0.606	0.656	0.881	0.744		0.647	<sup>2</sup> 0.930	0.446	0.532	0.886	0.603
Weight.....	0.690		.792	.886	.942	.744	.885	0.656		.779	.901	.957	.749	.898	0.647	0.608	.714	.873	.959	.676	.906
Stature.....	<sup>2</sup> .926	.744		.659	.701	.889	.816	<sup>2</sup> .904	.745		.629	.699	.879	.840	<sup>2</sup> .915	.729		.536	.636	.880	.767
Chest girth at armseye.....	.595	.899	.644		.848	.640	.788	.561	.925	.643		.875	.650	.792	.520	.890	.583		.850	.548	.781
Hip girth.....	.630	.960	.686	.873		.663	.836	.582	.966	.684	.893		.667	.863	.579	.947	.648	.854		.615	.856
Total posterior arm length.....	.896	.746	.894	.668	.698		.725	.886	.736	.892	.664	.676		.755	.882	.701	.862	.601	.642		.651
Vertical trunk girth.....	.714	.890	.824	.812	.870	.755		.663	.906	.820	.838	.886	.731		.700	.882	.804	.773	.836	.742	
	Kansas (354 boys and 473 girls)							Michigan (409 boys and 219 girls)							Minnesota (629 boys and 635 girls)						
Hip height.....		0.670	<sup>2</sup> 0.932	0.498	0.575	0.864	0.649		0.676	<sup>2</sup> 0.929	0.589	0.569	0.871	0.672		0.705	<sup>2</sup> 0.922	0.581	0.611	0.872	0.695
Weight.....	0.677		.761	.868	.946	.684	.897	0.684		.738	.907	.953	.733	.879	0.653	0.705	.772	.889	.947	.725	.864
Stature.....	<sup>2</sup> .926	.744		.589	.664	.858	.794	<sup>2</sup> .923	.762		.629	.633	.874	.783	<sup>2</sup> .889	.733		.628	.680	.853	.810
Chest girth at armseye.....	.566	.911	.597		.826	.568	.771	.592	.884	.671		.875	.668	.788	.561	.914	.622		.847	.627	.757
Hip girth.....	.593	.961	.667	.885		.604	.837	.587	.935	.664	.866		.659	.841	.603	.954	.674	.883		.649	.822
Total posterior arm length.....	.882	.719	.890	.611	.646		.662	.857	.706	.852	.679	.659		.709	.795	.661	.808	.591	.612		.701
Vertical trunk girth.....	.694	.885	.828	.793	.854	.726		.679	.884	.809	.821	.846	.689		.662	.887	.792	.802	.855	.650	
	Nebraska (202 boys and 194 girls)							Ohio (606 boys and 298 girls)							Pennsylvania (336 boys and 477 girls)						
Hip height.....		0.719	<sup>2</sup> 0.944	0.562	0.638	0.907	0.736		0.687	<sup>2</sup> 0.937	0.554	0.584	0.877	0.651		0.688	<sup>2</sup> 0.911	0.526	0.561	0.745	0.642
Weight.....	0.665		.794	.883	.959	.740	.904	0.699		.754	.860	.946	.701	.856	0.672	0.688	.760	.849	.932	.634	.861
Stature.....	<sup>2</sup> .915	.737		.620	.710	.888	.848	<sup>2</sup> .923	.758		.587	.652	.876	.776	<sup>2</sup> .913	.745		.577	.645	.759	.772
Chest girth at armseye.....	.561	.927	.611		.849	.632	.785	.567	.897	.616		.835	.617	.725	.590	.908	.645		.850	.548	.787
Hip girth.....	.586	.959	.660	.896		.674	.855	.614	.954	.674	.862		.624	.805	.624	.962	.693	.887		.572	.830
Total posterior arm length.....	.857	.693	.873	.594	.626		.743	.883	.723	.877	.623	.656		.665	.874	.736	.880	.662	.693		.607
Vertical trunk girth.....	.720	.912	.833	.824	.879	.723		.688	.900	.823	.788	.861	.702		.684	.863	.794	.791	.839	.713	
	Tennessee (404 boys and 322 girls)							Texas (480 boys and 532 girls)							Utah (411 boys and 352 girls)						
Hip height.....		0.681	<sup>2</sup> 0.922	0.549	0.587	0.893	0.682		0.624	<sup>2</sup> 0.916	0.534	0.507	0.854	0.617		0.707	<sup>2</sup> 0.930	0.579	0.621	0.886	0.674
Weight.....	0.614		.759	.859	.932	.684	.877	0.672		.708	.898	.948	.657	.878	0.691	0.707	.801	.888	.940	.754	.871
Stature.....	<sup>2</sup> .902	.723		.610	.677	.861	.820	<sup>2</sup> .917	.742		.580	.592	.840	.783	<sup>2</sup> .938	.762		.649	.720	.877	.804
Chest girth at armseye.....	.538	.914	.622		.816	.574	.758	.573	.908	.621		.865	.583	.763	.574	.881	.635		.844	.653	.767
Hip girth.....	.541	.963	.649	.889		.589	.832	.591	.959	.666	.881		.563	.817	.607	.943	.678	.839		.685	.842
Total posterior arm length.....	.838	.668	.849	.586	.608		.676	.862	.673	.864	.594	.601		.651	.894	.722	.890	.648	.643		.709
Vertical trunk girth.....	.639	.885	.793	.800	.859	.671		.646	.861	.809	.759	.826	.669		.714	.879	.831	.784	.846	.746	

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 47.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 12

Measurement	Alabama (533 boys and 544 girls)							California (278 boys and 274 girls)							Colorado (414 boys and 345 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height.....		0.724 <sup>2</sup>	0.937	0.633	0.664	0.893	0.732		0.681 <sup>2</sup>	0.940	0.561	0.568	0.898	0.673		0.684 <sup>2</sup>	0.910	0.562	0.596	0.862	0.667
Weight.....	0.598							0.603							0.673						
Stature.....	<sup>2</sup> 0.902	.727						<sup>2</sup> 0.916	.691					<sup>2</sup> 0.905	.738						
Chest girth at armsye.....	.513	.910	.614					.499	.909	.581				.628	.768						
Hip girth.....	.543	.965	.677	.889				.553	.964	.652	.881			.805	.959	.669	.882				
Total posterior arm length.....	.862	.665	.855	.595	.617		.746	.852	.673	.852	.577	.609		.686	.870	.710	.875	.620	.653		
Vertical trunk girth.....	.636	.903	.818	.797	.881	.686		.646	.888	.812	.794	.869	.695		.630	.861	.787	.765	.843	.673	
	District of Columbia, Maryland, and Virginia (917 boys and 680 girls)							Illinois (411 boys and 351 girls)							Iowa (321 boys and 323 girls)						
Hip height.....		0.724 <sup>2</sup>	0.927	0.592	0.636	0.880	0.720		0.717 <sup>2</sup>	0.940	0.589	0.631	0.887	0.726		0.691 <sup>2</sup>	0.928	0.586	0.619	0.862	0.707
Weight.....	0.595							0.635							0.612						
Stature.....	<sup>2</sup> 0.887	.693						<sup>2</sup> 0.887	.748					<sup>2</sup> 0.887	.744						
Chest girth at armsye.....	.468	.889	.557	.845	.883	.656	.795	.489	.906	.589				.479	.911	.602	.679				
Hip girth.....	.540	.960	.649	.853		.692	.837	.593	.966	.707	.886			.533	.954	.688	.872				
Total posterior arm length.....	.843	.668	.837	.557	.618		.744	.830	.717	.855	.605	.689		.861	.699	.861	.593	.641			
Vertical trunk girth.....	.635	.873	.802	.762	.855	.686		.644	.915	.824	.802	.901	.707	.633	.914	.811	.816	.888	.691		
	Kansas (518 boys and 580 girls)							Michigan (419 boys and 133 girls)							Minnesota (542 boys and 514 girls)						
Hip height.....		0.692 <sup>2</sup>	0.933	0.597	0.597	0.862	0.701		0.662 <sup>2</sup>	0.920	0.544	0.565	0.854	0.620		0.732 <sup>2</sup>	0.944	0.589	0.633	0.889	0.715
Weight.....	0.622							0.605							0.600						
Stature.....	<sup>2</sup> 0.903	.736						<sup>2</sup> 0.897	.732					<sup>2</sup> 0.871	.738						
Chest girth at armsye.....	.531	.923	.619		.846	.621	.802	.477	.858	.606				.483	.900	.611					
Hip girth.....	.561	.967	.690	.891		.633	.839	.509	.937	.668	.853			.538	.958	.677	.868				
Total posterior arm length.....	.867	.694	.876	.610	.639		.711	.837	.709	.857	.609	.643		.833	.695	.839	.603	.644			
Vertical trunk girth.....	.650	.904	.821	.824	.882	.713		.667	.886	.832	.780	.859	.743	.614	.883	.809	.778	.854	.688		
	Nebraska (162 boys and 171 girls)							Ohio (558 boys and 247 girls)							Pennsylvania (413 boys and 549 girls)						
Hip height.....		0.696 <sup>2</sup>	0.935	0.568	0.592	0.859	0.685		0.628 <sup>2</sup>	0.939	0.587	0.616	0.878	0.687		0.727 <sup>2</sup>	0.935	0.600	0.630	0.859	0.705
Weight.....	0.629							0.615							0.654						
Stature.....	<sup>2</sup> 0.888	.764						<sup>2</sup> 0.893	.730					<sup>2</sup> 0.912	.750						
Chest girth at armsye.....	.520	.913	.634		.831	.652	.766	.499	.911	.613				.559	.910	.637					
Hip girth.....	.566	.961	.714	.881		.641	.811	.544	.955	.666	.892			.596	.969	.701	.888				
Total posterior arm length.....	.859	.695	.862	.627	.658		.707	.863	.707	.856	.621	.659		.859	.738	.883	.661	.705			
Vertical trunk girth.....	.602	.912	.809	.803	.900	.660		.633	.891	.813	.802	.865	.684	.691	.885	.831	.788	.864	.762		
	Tennessee (336 boys and 302 girls)							Texas (443 boys and 576 girls)							Utah (347 boys and 253 girls)						
Hip height.....		0.728 <sup>2</sup>	0.934	0.640	0.650	0.895	0.700		0.623 <sup>2</sup>	0.914	0.522	0.528	0.869	0.632		0.643 <sup>2</sup>	0.905	0.535	0.563	0.870	0.608
Weight.....	0.604							0.609							0.638						
Stature.....	<sup>2</sup> 0.906	.727						<sup>2</sup> 0.891	.709					<sup>2</sup> 0.919	.745						
Chest girth at armsye.....	.476	.907	.588		.850	.674	.771	.494	.902	.571				.568	.901	.655					
Hip girth.....	.545	.966	.678	.883		.691	.854	.540	.959	.654	.879			.524	.949	.634	.867				
Total posterior arm length.....	.858	.689	.870	.559	.650		.722	.820	.627	.822	.525	.447		.857	.691	.858	.636	.593			
Vertical trunk girth.....	.650	.908	.816	.816	.878	.711		.606	.872	.808	.751	.854	.629	.641	.907	.793	.842	.867	.694		

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.  
<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 48.—Intercorrelations <sup>1</sup> of 7 measurements for each State for boys and girls aged 13

Measurement	Alabama (458 boys and 544 girls)							California (284 boys and 226 girls)							Colorado (328 boys and 265 girls)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height		0.703	0.933	0.606	0.618	0.899	0.694		0.670	0.928	0.568	0.573	0.890	0.674		0.627	0.903	0.504	0.534	0.860	0.630
Weight	0.521		.810	.906	.952	.743	.905	0.508		.796	.921	.968	.730	.907	0.509		.747	.899	.955	.709	.853
Stature	<sup>2</sup> .868	.683		.691	.734	.901	.840	<sup>2</sup> .900	.637		.679	.707	.891	.841	<sup>2</sup> .874	.651		.627	.647	.870	.814
Chest girth at armscye	.452	.905	.586		.869	.667	.814	.386	.914	.488		.909	.644	.828	.377	.887	.500		.860	.626	.768
Hip girth	.432	.960	.625	.859		.675	.860	.421	.963	.559	.891		.648	.857	.431	.936	.594	.827		.624	.812
Total posterior arm length	.839	.652	.850	.575	.592		.732	.867	.623	.850	.517	.560		.732	.823	.590	.835	.496	.542		.677
Vertical trunk girth	.546	.873	.787	.770	.860	.646		.550	.873	.771	.770	.837	.630		.533	.846	.764	.713	.816	.599	
District of Columbia, Maryland, and Virginia (1,117 boys and 641 girls)							Illinois (406 boys and 299 girls)							Iowa (229 boys and 181 girls)							
Hip height		0.700	0.917	0.596	0.617	0.888	0.712		0.751	0.933	0.627	0.675	0.855	0.737		0.653	0.924	0.603	0.549	0.857	0.693
Weight	0.516		.786	.884	.942	.748	.899	0.525		.828	.908	.955	.776	.898	0.448		.779	.915	.949	.725	.902
Stature	<sup>2</sup> .853	.642		.662	.698	.896	.854	<sup>2</sup> .893	.668		.695	.747	.887	.862	<sup>2</sup> .806	.711		.697	.680	.856	.865
Chest girth at armscye	.383	.875	.499		.846	.661	.805	.417	.913	.538		.869	.680	.812	.586	.919	.580		.861	.689	.826
Hip girth	.396	.941	.554	.836		.666	.852	.449	.964	.606	.873		.713	.858	.361	.946	.644	.871		.638	.846
Total posterior arm length	.831	.607	.801	.494	.531		.765	.863	.651	.864	.580	.593		.756	.815	.625	.822	.547	.560		.742
Vertical trunk girth	.746	.859	.754	.732	.824	.253		.570	.912	.761	.794	.885	.667		.464	.916	.778	.840	.894	.643	
Kansas (512 boys and 638 girls)							Michigan (278 boys and 72 girls)							Minnesota (601 boys and 603 girls)							
Hip height		0.718	0.927	0.581	0.632	0.875	0.707		0.670	0.927	0.549	0.557	0.857	0.660		0.735	0.939	0.601	0.658	0.901	0.731
Weight	0.478		.811	.892	.953	.753	.905	0.627		.801	.913	.957	.779	.908	0.506		.829	.899	.959	.780	.906
Stature	<sup>2</sup> .848	.679		.669	.720	.884	.850	<sup>2</sup> .895	.771		.670	.692	.879	.821	<sup>2</sup> .836	.671		.693	.754	.807	.848
Chest girth at armscye	.386	.898	.542		.850	.663	.823	.477	.907	.632		.888	.712	.815	.340	.834	.483		.872	.669	.832
Hip girth	.373	.952	.605	.855		.675	.850	.505	.936	.687	.856		.692	.859	.413	.932	.597	.790		.723	.870
Total posterior arm length	.802	.625	.819	.539	.555		.741	.859	.722	.888	.633	.635		.730	.783	.580	.797	.455	.519		.750
Vertical trunk girth	.480	.864	.764	.777	.838	.612		.589	.865	.786	.790	.803	.647		.491	.860	.722	.684	.819	.549	
Nebraska (134 boys and 118 girls)							Ohio (519 boys and 197 girls)							Pennsylvania (461 boys and 545 girls)							
Hip height		0.758	0.926	0.658	0.694	0.898	0.724		0.713	0.921	0.598	0.635	0.898	0.680		0.689	0.920	0.584	0.612	0.864	0.702
Weight	0.542		.844	.918	.955	.815	.898	.544		.808	.906	.963	.762	.898	0.460		.784	.891	.925	.752	.880
Stature	<sup>2</sup> .894	.698		.734	.784	.887	.885	<sup>2</sup> .874	.664		.679	.730	.894	.843	<sup>2</sup> .856	.642		.671	.707	.806	.848
Chest girth at armscye	.378	.889	.514		.867	.755	.820	.501	.895	.606		.877	.676	.808	.364	.893	.513		.889	.657	.813
Hip girth	.481	.950	.644	.835		.675	.855	.471	.944	.611	.879		.690	.860	.369	.957	.574	.858		.685	.861
Total posterior arm length	.857	.644	.875	.509	.592		.763	.845	.604	.839	.591	.561		.724	.782	.585	.805	.492	.528		.762
Vertical trunk girth	.632	.892	.830	.737	.865	.689		.549	.863	.777	.801	.863	.614		.482	.857	.740	.747	.831	.571	
Tennessee (344 boys and 232 girls)							Texas (368 boys and 443 girls)							Utah (216 boys and 129 girls)							
Hip height		0.734	0.935	0.661	0.642	0.910	0.728		0.672	0.916	0.553	0.582	0.863	0.688		0.727	0.920	0.629	0.654	0.899	0.664
Weight	0.514		.817	.915	.952	.779	.912	0.525		.782	.904	.956	.721	.907	0.600		.827	.888	.953	.766	.891
Stature	<sup>2</sup> .890	.636		.738	.720	.903	.857	<sup>2</sup> .847	.664		.659	.691	.870	.853	<sup>2</sup> .912	.709		.689	.751	.869	.827
Chest girth at armscye	.410	.886	.523		.882	.720	.845	.420	.895	.508		.869	.609	.819	.422	.871	.515		.852	.485	.794
Hip girth	.473	.956	.619	.832		.693	.863	.464	.960	.614	.862		.628	.860	.429	.950	.620	.822		.689	.858
Total posterior arm length	.839	.598	.853	.491	.567		.755	.794	.596	.795	.477	.557		.737	.846	.591	.850	.470	.482		.700
Vertical trunk girth	.554	.846	.756	.748	.833	.582		.660	.869	.760	.728	.843	.744		.596	.886	.744	.743	.876	.604	

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 49.—Intercorrelations<sup>1</sup> of 7 measurements for each State for boys and girls aged 14

Measurement	Alabama (410 boys and 421 girls)						California (277 boys and 188 girls)						Colorado (294 boys and 172 girls)									
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	
Hip height		0.702	0.929	0.614	0.629	0.902	0.724		0.644	0.901	0.558	0.523	0.863	0.630		0.640	0.897	0.437	0.552	0.860	0.641	
Weight	0.329		.819	.923	.969	.771	.922	0.524		.834	.899	.941	.720	.833	0.501	0.640		.808	.890	.949	.733	.899
Stature	0.845	0.533		.714	.750	.905	.873	0.916	0.641		.599	.643	.877	.820	0.834	0.664	0.808		.652	.721	.887	.853
Chest girth at armsye	.207	.873	.356		.903	.695	.848	.312	.876	.430		.861	.600	.714	.346	.819	.439		.842	.618		.803
Hip girth	.249	.945	.471	.824		.713	.879	.375	.938	.506	.844		.620	.763	.372	.943	.578	.775		.653		.859
Total posterior arm length	.769	.503	.798	.380	.440		.764	.863	.585	.840	.397	.457		.701	.519	.449	.562	.245	.362			.724
Vertical trunk girth	.390	.846	.685	.687	.824	.551		.526	.859	.719	.736	.820	.560		.365	.808	.665	.600	.804	.371		
District of Columbia, Maryland, and Virginia (894 boys and 470 girls)																						
Hip height		0.646	0.904	0.548	0.549	0.867	0.665	Illinois (282 boys and 156 girls)						Iowa (168 boys and 134 girls)								
Weight	0.446		.780	.900	.950	.731	.895	0.513	0.727	0.919	0.589	0.665	0.878	0.732	0.438	0.657	0.900	0.539	0.581	0.820	0.628	
Stature	0.868	0.598		.664	.683	.882	.854	0.868	.576	.834	.672	.781	.878	.839	0.865	.585	.826	.716	.765	.865	.860	
Chest girth at armsye	.338	.863	.435		.864	.636	.812	.309	.839	.348		.822	.670	.781	.330	.898	.468		.904	.720	.845	
Hip girth	.375	.934	.538	.805		.637	.847	.372	.917	.450	.788		.740	.831	.351	.955	.509	.857		.745	.887	
Total posterior arm length	.867	.573	.818	.470	.491		.744	.838	.608	.849	.428	.476		.787	.809	.575	.838	.510	.500		.754	
Vertical trunk girth	.467	.786	.694	.667	.765	.539		.447	.810	.670	.670	.753	.583		.397	.804	.654	.715	.797	.502		
Kansas (398 boys and 504 girls)																						
Hip height		0.677	0.909	0.569	0.599	0.877	0.653	Michigan (225 boys and 60 girls)						Minnesota (473 boys and 469 girls)								
Weight	0.415		.816	.901	.960	.747	.892	0.436	0.713	0.908	0.616	0.615	0.884	0.654	0.382	0.667	0.906	0.547	0.575	0.871	0.683	
Stature	0.845	0.577		.715	.741	.925	.854	0.774	.659	.859	.913	.957	.812	.914	0.803	.476	.802	.902	.951	.711	.890	
Chest girth at armsye	.251	.868	.396		.844	.681	.826	.326	.888	.542		.876	.733	.839	.238	.835	.294		.682	.719	.874	
Hip girth	.271	.941	.471	.814		.699	.847	.358	.948	.576	.838		.747	.894	.244	.908	.371	.781		.641	.846	
Total posterior arm length	.789	.501	.801	.392	.396		.764	.812	.589	.819	.527	.530		.769	.728	.428	.743	.310	.334		.722	
Vertical trunk girth	.372	.848	.651	.724	.821	.480		.378	.863	.679	.781	.836	.547		.394	.788	.627	.630	.740	.465		
Nebraska (52 boys and 41 girls)																						
Hip height		0.658	0.892	0.511	0.565	0.887	0.617	Ohio (356 boys and 124 girls)						Pennsylvania (429 boys and 405 girls)								
Weight	0.461		.811	.909	.928	.704	.831	0.504	0.723	0.932	0.594	0.651	0.879	0.709	0.418	0.680	0.913	0.592	0.591	0.864	0.689	
Stature	0.897	0.635		.664	.706	.861	.850	0.850	.667	.819	.895	.960	.762	.907	0.841	.603	.825	.913	.953	.778	.914	
Chest girth at armsye	.398	.878	.494		.870	.648	.825	.338	.884	.476		.857	.682	.823	.251	.834	.418		.733	.746	.902	
Hip girth	.199	.911	.401	.769		.623	.816	.419	.936	.607	.825		.694	.867	.282	.935	.487	.780		.703	.888	
Total posterior arm length	.838	.595	.896	.491	.376		.670	.800	.568	.844	.439	.493		.734	.803	.500	.794	.393	.394		.768	
Vertical trunk girth	.396	.867	.638	.785	.542	.546		.476	.880	.731	.732	.870	.566		.327	.811	.615	.632	.768	.413		
Tennessee (195 boys and 149 girls)																						
Hip height		0.723	0.921	0.619	0.644	0.901	0.689	Texas (213 boys and 304 girls)						Utah (111 boys and 36 girls)								
Weight	0.539		.846	.910	.953	.865	.931	0.350	0.710	0.923	0.592	0.624	0.842	0.727	0.373	0.804	0.925	0.721	0.726	0.884	0.754	
Stature	0.861	0.696		.717	.773	.897	.851	0.821	.526	.800	.924	.966	.759	.896	0.895	.551	.888	.905	.954	.826	.883	
Chest girth at armsye	.383	.858	.528		.862	.710	.838	.216	.873	.337		.707	.872	.885	.256	.788	.360	.780	.830	.882	.893	
Hip girth	.424	.931	.590	.821		.730	.887	.244	.927	.421	.820		.682	.836	.188	.890	.352	.702		.745	.876	
Total posterior arm length	.765	.578	.799	.435	.481		.748	.796	.478	.787	.341	.380		.773	.847	.453	.751	.419	.300		.875	
Vertical trunk girth	.516	.878	.757	.760	.817	.548		.298	.825	.652	.662	.769	.455		.342	.833	.596	.584	.662	.334		

<sup>1</sup> For each State the intercorrelations for the measurements of the boys are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

The technique of analysis of ranks was used in testing regional differences (2). Each State was ranked according to the size of the mean of a given measurement of children of a given age and sex. The rank of 1 was given to the State that had the largest mean for the particular measurement, age, and sex considered. Rank 2 was given to the State in which the children had the next largest mean, and so on up to rank 15 (since 15 regions were included in this study). Such rankings were applied to each age from 6 to 14, inclusive, for the means of each of 19 measurements for boys and girls separately. Tables were constructed for each sex and for each of the 19 measurements, giving the ranks of the States for each age. The values of chi-square subscript  $r$  (2) computed from these ranks (table 50) for all the 19 measurements indicate that the means of each of the 19 measurements differ significantly from State to State.<sup>29</sup>

<sup>29</sup> An analysis of variance (1), based on the values of the measurements rather than their ranks, was performed on seven measurements for both sexes, aged 6 through 14 years, to test the significance of differences among the means of the 15 States. In every instance the results obtained showed significant difference among the means of the various States for a given measurement, sex, and age. Since these results were in agreement with those obtained by the method of ranks they need not be listed here.

TABLE 50.—The values of  $\chi^2_r$  for 19 measurements, calculated by ranking the States by the size of the means of these measurements for each age

Measurement	$\chi^2_r$ values for 1—	
	Boys	Girls
Waist height.....	81.30	79.63
Hip height.....	83.32	78.21
Weight.....	97.72	88.19
Stature.....	73.45	69.76
Cervicale height.....	74.60	67.04
Tibiale height.....	95.17	91.20
Bitrochanteric diameter.....	95.10	93.71
Chest girth at armseye.....	92.81	93.27
Waist girth.....	98.58	103.64
Hip girth.....	99.93	91.34
Neck-base girth.....	87.68	97.93
Armseye girth.....	87.06	94.46
Upper-arm girth.....	102.27	102.14
Total posterior arm length.....	81.47	75.77
Thigh girth.....	102.56	102.92
Maximum calf girth.....	96.23	94.64
Knee girth.....	102.82	101.16
Total crotch length.....	111.06	108.28
Vertical trunk girth.....	91.27	88.47

<sup>1</sup> For 14 degrees of freedom  $\chi^2 = 23.685$  for the 5-percent level of significance and 29.141 for the 1-percent level of significance.

Table 51 is presented as an example of how the States ranked with respect to some of the measurements.

TABLE 51.—Ranking of States by the size of the mean for each of 5 measurements, and for each age group, 6 to 14

Age (years)	BOYS															GIRLS																													
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah															
6.....	13	2	14	4	1	12	10	3	9	7	11	8	15	5	6	10	2	15	3	1	8	12	4	14	11	6	7	9	5	13															
7.....	14	1	15	5	2	11	12	4	7	6	10	9	13	3	8	14	1	13	4	2	9	7	3	6	12	11	10	15	8	5															
8.....	15	1	14	3	2	7	5	4	6	10	12	9	13	8	11	15	1	12	4	3	5	9	2	6	10	11	7	13	8	14															
9.....	15	1	13	3	5	7	11	8	2	9	12	6	14	4	10	15	1	13	3	2	6	8	4	5	9	11	10	14	7	12															
10.....	14	1	13	4	3	8	9	6	7	5	11	10	15	2	12	12	1	13	6	2	7	9	3	8	10	11	5	15	4	14															
11.....	14	1	13	6	2	4	9	6	7	11	10	5	15	3	12	13	1	14	7	2	9	3	10	4	6	12	5	15	8	11															
12.....	15	1	10	2	5	8	3	11	6	13	9	7	14	4	12	13	1	11	2	8	6	3	14	4	10	9	7	12	5	15															
13.....	15	1	10	2	5	7	6	12	3	11	9	4	13	8	14	10	1	11	2	5	8	6	15	3	12	9	4	13	7	14															
14.....	14	1	13	2	5	7	8	6	3	12	11	4	10	9	15	13	1	9	7	3	6	4	12	2	11	10	5	14	8	15															
Total.....	129	10	115	33	30	71	73	60	50	84	95	62	122	46	100	115	10	111	38	28	64	61	67	52	91	90	60	120	60	113															
Age (years)	STATURE															CHEST GIRTH AT ARMSCYE																													
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah															
6.....	13	2	10	6	1	14	8	7	11	5	9	12	15	4	3	7	2	14	5	1	12	10	8	13	9	6	15	11	4	3															
7.....	11	2	15	6	1	14	8	7	10	4	9	13	12	5	3	14	2	9	5	3	10	6	4	8	11	12	13	15	7	1															
8.....	14	1	11	5	2	10	3	9	7	6	12	14	13	8	4	12	1	11	5	3	9	6	8	2	10	13	15	14	4	7															
9.....	15	1	9	6	7	8	11	10	4	2	12	13	14	5	3	13	1	6	5	11	8	10	7	3	2	12	15	14	9	4															
10.....	13	1	10	8	5	12	6	9	7	3	11	15	14	2	4	13	1	10	11	8	9	3	4	5	6	14	12	15	2	7															
11.....	14	1	7	8	4	6	2	9	5	13	12	11	15	3	10	10	1	11	5	6	8	2	12	7	3	14	13	15	4	9															
12.....	12	1	6	2	5	11	3	14	7	15	9	8	13	4	10	7	1	10	3	11	6	5	15	4	8	9	14	13	2	12															
13.....	13	1	5	2	7	11	3	14	4	9	8	10	15	6	12	5	1	8	6	9	11	4	15	3	7	14	10	12	2	13															
14.....	11	1	10	2	6	5	4	9	3	13	14	8	7	12	15	4	2	3	12	9	5	7	11	6	8	10	14	13	1	15															
Total.....	116	11	83	45	38	91	48	88	58	70	96	104	118	49	64	85	12	82	57	61	78	53	84	51	64	104	121	122	35	71															
Age (years)	WEIGHT															STATURE															CHEST GIRTH AT ARMSCYE														
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah															
6.....	9	1	8	6	2	14	7	5	13	12	11	10	15	3	4	10	2	13	5	1	7	8	4	14	12	11	9	15	3	6															
7.....	14	1	11	7	3	13	8	4	10	6	12	9	15	2	5	11	1	10	7	2	5	6	3	12	14	13	9	15	8	4															
8.....	14	1	11	6	3	8	4	2	10	12	13	9	15	5	7	14	1	12	5	3	4	7	2	10	11	13	9	15	6	8															
9.....	14	1	8	5	9	10	6	4	13	12	11	7	15	3	14	1	9	7	7	3	5	4	10	11	13	12	15	8	6																
10.....	14	1	9	8	6	12	7	3	13	4	10	11	15	2	5	14	1	12	7	2	3	8	5	9	11	13	6	15	4	10															
11.....	14	1	10	9	5	7	8	3	11	13	12	4	15	2	6	14	1	12	6	2	5	3	10	7	9	13	4	15	6	11															
12.....	13	1	9	2	6	12	4	10	7	14	11	5	15	3	8	14	1	9	5	2	4	3	13	7	11	10	8	15	6	12															
13.....	15	1	8	3	4	5	6	10	9	13	11	2	14	7	12	13	1	6	7	2	8	9	14	5	12	10	3	15	4	11															
14.....	14	1	9	4	5	8	6	3	7	13	12	2	15	10	11	13	1	3	11	2	7	8	9	4	12	10	6	15	5	14															
Total.....	121	9	83	50	43	89	56	44	93	99	103	59	134	36	61	117	10	86	62	18	46	57	64	78	103	106	66	135	50	82															



TABLE 51.—Ranking of States by the size of the mean for each of 5 measurements, and for each age group, 6 to 14—Continued

HIP GIRTH

Age (years)	Boys										Girls																			
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah
6	10	2	14	4	1	7	9	5	11	6	13	12	15	3	8	6	2	15	4	1	7	9	5	13	8	12	10	11	3	14
7	12	2	15	4	1	6	10	8	9	5	13	7	14	3	11	11	1	13	3	2	5	6	5	7	12	14	9	15	4	10
8	13	1	12	3	2	7	6	5	10	9	15	8	14	4	11	11	1	13	4	3	5	9	2	10	14	8	12	6	15	
9	14	1	12	3	2	6	9	10	5	8	13	4	15	2	11	13	1	11	1	11	7	8	4	6	9	12	10	15	3	14
10	14	1	13	4	5	7	6	9	8	3	12	10	15	2	11	11	1	12	1	12	7	9	4	8	10	13	6	14	3	15
11	14	1	11	7	4	3	9	5	9	10	12	6	15	2	13	12	2	13	2	3	10	4	11	7	6	15	9	14	5	1
12	14	1	9	2	6	8	4	11	7	12	10	5	13	3	15	11	1	13	2	5	7	3	14	6	9	10	8	12	4	15
13	15	1	12	2	5	6	4	11	8	9	10	3	13	7	14	9	1	12	2	4	8	7	14	3	11	10	5	13	6	15
14	12	1	14	2	6	4	5	8	7	10	13	3	11	9	15	11	1	10	7	2	5	3	13	4	8	12	9	14	6	15
Total	118	11	112	31	38	54	61	72	74	71	111	58	125	35	109	95	11	112	40	24	61	58	75	61	83	112	74	120	40	114

TOTAL POSTERIOR ARM LENGTH

6	12	2	11	3	1	15	7	8	9	5	13	10	14	4	6	10	3	11	12	1	15	7	4	9	6	8	13	14	5	2	
7	10	2	14	5	1	15	9	7	8	4	13	11	12	6	3	14	3	8	10	2	12	4	5	6	7	15	11	13	9	1	
8	12	1	10	3	4	14	2	7	8	5	13	11	15	9	6	15	1	9	12	2	10	6	4	3	7	14	11	13	8	5	
9	14	1	11	5	7	12	9	10	3	2	13	6	15	8	4	15	1	7	9	8	11	6	3	2	2	5	14	12	13	10	4
10	11	1	10	8	3	14	4	7	9	2	12	13	15	5	6	13	1	7	12	5	11	3	5	4	6	14	10	15	8	9	
11	12	1	10	7	4	11	2	5	3	13	14	6	15	8	9	12	1	10	11	4	13	2	2	7	3	14	9	15	6	8	
12	9	1	7	2	4	14	3	12	6	15	11	8	13	5	10	11	2	8	1	6	12	4	10	3	7	13	14	15	5	9	
13	11	1	6	2	5	15	3	12	4	7	10	9	13	8	14	7	2	6	4	11	13	3	15	1	8	14	9	12	5	10	
14	8	1	12	2	9	10	3	4	5	11	14	7	6	13	15	6	12	2	11	10	9	7	3	1	5	8	14	15	4	13	
Total	99	11	91	37	38	120	42	72	55	64	113	81	118	66	73	103	26	68	82	49	106	42	51	36	54	114	103	125	60	61	

An examination of table 51 shows that for some States the ranks follow a consistent pattern. Thus, California on the whole, ranks first and Tennessee and Alabama rank last—not only for all of the measurements<sup>30</sup> but what is more significant, for all age groups and each sex. The consistency of these results for each age and sex precludes a chance occurrence explanation. Thus, it would seem that the children measured in California were, on the whole, larger than those measured in most of the other States; and the children measured in Tennessee and Alabama were, on the whole, smaller. Since children in only a few communities in each State could be measured (see p. 2), these conclusions may or may not be applicable to the total population of children

<sup>30</sup> Since the measurements are correlated, the same test that was applied to test the consistency of the ranks for a given measurement for each of the age groups cannot be applied to test the consistency of the ranks for each of the measurements for a given age group.

in the States involved. It should also be noted that if children were classified on the basis of selected body measurements, rather than of age (see p. 51), differences in the other measurements of the children in different regions might be negligible.

An analysis of ranks was also carried out for the 19 measurements ranking the States by the size of the standard deviation. Rank 1 was given the State in which the children had the largest standard deviation for a given measurement for a given age and sex. Examples of the type of ranks obtained are given in table 52. Here it will be noticed that the rankings are not as consistent as they were for the means. However, a  $\chi^2_7$  test shows that there exists significant variations among States as regards the standard deviation of the 19 measurements. The values of  $\chi^2_7$  are given in table 53.

TABLE 52.—Ranking of States by the size of the standard deviation for each of 5 measurements, and for each age group, 6 to 14

WEIGHT

Age (years)	Boys												Girls																		
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	
6	15	10	14	5	1	8	13	3	6	7	4	9	11	2	12	14	8	12	7	1	15	11	2	9	4	3	6	10	5	13	
7	15	8	9	3	2	12	5	14	10	6	7	11	4	1	13	14	2	13	6	1	12	6	3	5	11	15	4	9	7	13	
8	15	2	14	4	1	12	7	6	11	8	10	9	5	12	13	15	4	11	6	5	3	13	2	7	14	1	1	10	12	10	
9	15	11	10	2	9	8	7	13	3	5	5	1	12	4	14	15	2	12	4	1	10	9	5	8	11	6	3	13	7	14	
10	15	1	14	5	3	6	12	9	7	11	10	2	13	4	8	13	5	11	6	1	7	14	3	9	12	8	3	4	10	15	
11	12	1	14	8	2	3	9	5	5	11	10	4	15	7	13	14	4	10	5	3	12	7	5	5	12	2	1	11	9	13	
12	11	4	9	1	2	3	8	13	5	13	14	3	6	1	13	4	1	13	4	7	9	3	15	5	10	2	11	12	14	14	
13	14	1	13	4	6	5	12	9	3	7	8	12	10	15	5	1	10	9	3	2	8	15	11	12	6	4	14	7	13	13	
14	7	5	13	3	4	12	9	8	6	15	10	1	11	11	12	14	4	13	8	3	2	6	3	9	10	1	12	14	11	15	15
Total	119	43	110	35	30	55	79	80	59	84	68	45	94	62	117	102	81	105	59	27	72	77	56	68	79	78	35	93	81	116	116

STATURE

6	15	4	11	5	8	12	10	9	6	1	7	13	3	14	2	14	12	10	13	1	15	5	2	6	9	3	11	4	7	8	2
7	13	8	1	2	4	15	7	14	11	6	9	5	3	12	10	15	7	10	6	1	14	9	4	8	11	13	5	3	12	12	3
8	13	11	7	1	2	15	10	8	5	9	4	6	3	14	12	11	10	12	2	1	7	14	4	5	3	15	8	9	13	6	6
9	14	11	12	1	6	10	9	13	2	5	3	4	8	15	7	15	5	14	1	2	9	3	12	8	13	7	4	10	11	6	6
10	14	1	12	4	3	2	5	8	9	11	10	7	13	15	6	14	12	13	4	1	7	9	3	10	8	6	5	2	15	11	11
11	12	14	13	3	1	9	4	8	10	2	7	6	11	15	5	10	6	9	2	3	13	4	7	11	5	12	1	15	14	8	8
12	10	7	8	2	4	3	6	13	1	11	9	5	12	14	15	9	2	8	10	14	11	4	5	6	12	15	1	3	13	7	7
13	9	7	13	4	3	8	12	10	2	6	11	1	5	14	15	9	8	7	12	1	3	13	2	14	6	4	5	10	15	11	11
14	3	14	9	11	6	10	7	2	5	15	4	1	12	8	13	6	3	4	13	1	8	11	15	12	2	7	10	9	14	5	5
Total	103	77	86	33	37	84	70	85	51	66	64	48	70	121	85	103	65	87	63	25	87	72	54	80	69	82	50	65	114	64	64

CHEST GIRTH AT ARMSCYE

6	14	15	12	7	1	8	13	3	6	9	4	5	10	2	11	13	3	9	5	1	12	10	8	11	5	9	4	2	6	15	7	14
7	15	13	5	4	3	8	11	2	14	9	10	6	7	1	12	13	2	12	10	1	9	8	7	7	5	9	14	15	4	3	14	6
8	15	4	14	2	1	9	9	3	10	7	11	13	6	8	12	14	5	11	6	4	10	12	6	7	14	10	12	7	10	15	15	
9	15	11	12	3	3	14	5	4	6	12	11	2	10	4	13	15	2	11	3	1	10	13	3	13	9	9	2	4	10	15	14	
10	15	1	13	3	5	5	14	6	7	10	13	3	15	7	12	15	4	12	5	1	8	13	3	11	14	3	4	8	10	15	14	
11	11	2	14	9	1	4	8	4	6	10	13	3	15	4	7	15	10	1	7	6	2	10	11	7	14	3	13	1	9	14	14	
12	12	3	9	1	2	13	11	6	14	8	11	6	13	7	15	10	1	7	11	4	11	4	3	14	8	12	13	2	5	6	15	
13	15	2	12	3	5	9	13	7	4	11	8	1	6	10	14	6	1	12	11	4	2	8	15	14	9	7	3	13	5	10	10	
14	8	7	12	6	1	2	9	3	5	15	10	4	11	13	14	12	3	14	10	6	4	11	1	7	5	2	8	13	9	15	15	
Total	120	58	103	38	40	71	89	45	67	89	87	40	86	57	110	110	27	99	65	22	71	80	67	79	78	81	31	83	69	118	118	

HIP GIRTH

6	15	12	14	8	1	9	11	4	6	7	3	5	10	2	13	13	7	11	6	1	14	10	2	12	4	5	3	9	8	15	9
7	12	14	13	4	3	10	5	9	8	6	11	7	2	1	15	14	3	15	10	1	11	5	6	4	12	13	2	7	8	12	3
8	15	3	13	2	1	6	8	5	9	7	11	10	4	12	14	14	8	11	6	2	5	13	4	3	10	12	1	7	9	15	15
9	15	13	10	3	6	7	9	12	4	5	8	1	11	2	14	15	2	13	5	1	10	6	4	8	11	9	3	12	7	14	14
10	14	1	15	6	3	8	9	10	7	12	13	2	11	4	5	11	8	10	2	1	5	13	14	7	12	6	4	3	9	15	15
11	12	1	13	9	2	5	11	4	7	10	8	3	15	6	14	15	8	11	5	3	12	3	6	4	2	13	1	9	10	14	14
12	9	3	11	1	5	6	4	14	8	13	10	2	12	7	15	6	1	10	4	5	11	7	3	15	7	9	12	2	8	13	14
13	12	5	14	2	9	4	13	8	3	11	7	1	6	10	15	4	5	9	10	2	1	7	12	14	13	6	3	11	8	15	15
14	4	6	13	3	5	1	10	7	15	8	2	9	12	14	4	11	10	1	8	6	1	5	2	9	7	3	12	13	14	15	15
Total	108	58	116	38	35	56	81	75	59	86	79	33	80	56	119	96	53	100	56	22	70	69	65	68	80	79	31	79	86	126	126

TOTAL POSTERIOR ARM LENGTH

6	15	7	8	4	9	14	3	12	11	2	10	5	1	13	6	14	6	10	9	1	15	7	2	11	13	3	8	4	5	12	12
7	15	9	5	2	1	14	6	11	12	10	13	3	4	7	8	15	6	9	7	1	14	5	2	10	13	11	8	4	4	12	3
8	15	6	7	1	5	13	12	11	8	9	4	3	2	14	10	11	10	9	1	3	2	13	8	6	12	15	4	5	14	7	2
9	14	12	5	3	4	13	10	11	2	8	7	1	6	15	9	15	4	12	1	5	11	3	9	6	14	10	7	13	8	2	2
10	14	3	13	4	6	1	8	7	5	9	10	2	12	15	11	13	9	12	4	1	14	6	3	8	11	7	5	2	15	10	10
11	14	10	11	4	2	13	12	7	6	3	9	1	8	15	5	8	7	10	1	2	13	3	5	12	6	11	4	15	14	9	9
12	10	5	8	2	3	6	7	11	1	9	12	4	14	13	15	5	9	13	3	11	7	8	2	4	14	15	1	12	6	10	10
13	13	2	14	4	9	7	8	10	1	6	11	3	5	15	12	10	11	6	4	1	9	13	3	14	12	5	7	8	15	2	2
14	1	15	9	3	8	14	7	10	11	4	6	2	12	13	5	11	3	1	14	5	6	8	7	10	2	13	9	15	12	4	4
Total	111	69	80	27	47	95	73	90	57	60	82	24	64	120	81	102	65	82	44	30	91	66	41	81	97	90	53	78	101	59	59

TABLE 53.—The values of  $\chi^2_7$  for 19 measurements calculated by ranking the States by the size of the standard deviations of these measurements for each age

Measurement	$\chi^2_7$ values <sup>1</sup> for—	
	Boys	Girls
Waist height.....	52.44	42.52
Hip height.....	60.11	40.49
Weight.....	64.98	56.30
Stature.....	44.09	36.71
Cervicale height.....	42.34	33.10
Tibiale height.....	53.31	32.88
Bitrochanteric diameter.....	51.78	45.56
Chest girth at armscye.....	58.49	60.72
Waist girth.....	67.99	55.99
Hip girth.....	59.83	52.83
Neck-base girth.....	65.82	46.97
Armscye girth.....	76.79	64.92
Upper-arm girth.....	58.54	61.11
Total posterior arm length.....	57.33	41.07
Thigh girth.....	63.28	54.44
Maximum calf girth.....	46.77	45.81
Knee girth.....	42.98	49.49
Total crotch length.....	49.39	38.68
Vertical trunk girth.....	38.91	43.40

<sup>1</sup> For 14 degrees of freedom  $\chi^2=23.685$  for the 5-percent level of significance and 29.141 for the 1-percent level of significance.

The next rank analysis was performed on the coefficient of variation for the 4 measurements: Stature, total posterior arm length, hip girth, and chest girth. The ranks of the coefficient of variation by State for each age are given in table 54. The values of  $\chi^2_7$  for these ranks are given in table 55.

TABLE 54.—Ranking of States by the size of the coefficient of variation for each of 4 measurements, and for each age group, 6 to 14

Age (years)	STATURE																															
	Boys												Girls																			
	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah	Alabama	California	Colorado	District of Columbia, Maryland, and Virginia	Illinois	Iowa	Kansas	Michigan	Minnesota	Nebraska	Ohio	Pennsylvania	Tennessee	Texas	Utah		
6.....	14	4	11	6	12	10	8	9	5	1	7	13	2	15	3	14	12	10	13	1	15	6	2	5	3	11	4	7	8			
7.....	13	8	1	2	6	15	5	14	11	7	9	4	3	12	10	15	10	6	1	14	9	4	7	11	13	5	3	12	2			
8.....	13	12	7	1	4	15	10	8	6	9	3	5	2	14	11	10	11	12	2	1	15	4	6	3	14	5	9	13	7			
9.....	14	12	11	1	6	10	9	13	3	5	2	4	5	15	7	15	8	13	1	1	12	9	3	12	10	14	5	4	11	6		
10.....	14	1	11	4	3	2	5	8	9	12	10	6	6	13	15	13	14	12	4	1	1	9	3	11	7	6	6	15	10			
11.....	12	15	13	3	1	9	4	8	11	2	7	6	10	14	5	11	8	9	3	13	5	4	12	3	13	10	1	15	14	6		
12.....	10	7	8	3	4	2	6	13	1	11	9	5	12	14	15	9	4	8	12	13	10	5	3	6	11	15	1	14	7	9		
13.....	8	11	13	4	3	9	12	7	2	6	10	1	5	15	14	11	10	1	12	1	3	13	12	14	6	4	5	15	9	7		
14.....	3	14	9	13	6	10	8	2	5	15	4	1	11	7	12	6	3	4	13	1	8	11	15	12	2	10	9	14	5	6		
Total.....	101	84	84	37	45	82	67	82	53	68	61	45	66	121	84	104	80	83	65	24	87	76	49	83	71	76	48	59	115	60		
CHEST GIRTH AT ARMSCYE																																
6.....	14	15	11	7	1	8	13	3	6	9	4	5	10	2	12	13	4	8	5	1	12	11	9	10	3	2	6	14	7	15		
7.....	15	14	5	4	3	8	11	2	13	10	9	7	6	1	12	14	5	9	10	1	11	8	7	4	13	15	3	12	6	6		
8.....	15	4	14	2	1	6	11	3	9	7	8	13	5	10	12	12	8	11	4	6	3	13	12	10	7	14	1	9	5	15		
9.....	15	12	11	3	14	9	4	6	7	2	10	1	8	5	13	15	3	11	2	1	12	5	7	13	9	6	4	10	5	14		
10.....	15	1	13	3	10	4	14	6	7	12	11	2	9	5	8	12	10	11	5	1	8	14	4	6	13	7	2	3	9	15		
11.....	11	5	15	8	4	1	9	3	6	10	12	2	14	7	13	14	7	11	5	3	10	8	12	4	2	13	1	6	9	15		
12.....	11	4	9	1	12	3	8	12	6	14	10	5	13	7	15	6	1	7	10	5	13	3	14	8	11	12	2	4	9	15		
13.....	15	4	12	3	6	9	13	7	2	11	8	1	5	10	14	6	1	13	12	3	4	8	15	14	9	7	2	10	5	11		
14.....	5	11	12	7	1	2	8	3	6	15	10	4	9	13	14	12	5	14	6	10	3	13	1	7	4	8	11	9	15	15		
Total.....	116	70	102	38	42	50	91	45	62	90	82	40	79	60	113	104	44	95	59	31	76	86	71	76	71	78	29	69	70	121		
HIP GIRTH																																
6.....	15	12	13	8	1	9	11	4	6	7	2	5	10	3	14	13	9	10	6	1	14	11	2	12	5	4	3	7	8	15		
7.....	13	15	12	4	3	11	5	9	8	6	10	7	2	1	14	14	7	15	10	2	13	5	6	3	12	11	1	4	8	9		
8.....	15	4	13	3	1	6	10	5	9	7	8	11	2	12	14	14	11	9	7	3	4	13	5	2	10	12	1	6	8	15		
9.....	15	13	11	3	6	8	9	12	4	5	7	1	10	2	14	15	4	13	5	1	10	6	3	9	11	8	2	12	7	14		
10.....	14	2	15	7	3	8	10	11	6	12	13	1	9	4	5	10	13	8	3	1	6	14	4	9	11	7	5	2	12	15		
11.....	11	5	13	9	1	4	12	3	6	10	8	2	15	7	14	10	9	4	3	12	7	7	5	6	2	11	1	8	13	15		
12.....	7	6	11	1	4	3	5	14	8	13	10	2	12	9	15	4	3	8	6	7	12	2	15	9	10	11	1	5	13	14		
13.....	12	10	13	2	8	4	14	6	3	11	7	1	5	9	15	2	6	8	11	3	1	7	12	15	14	5	4	10	9	13		
14.....	3	10	14	4	5	1	11	9	8	15	6	2	7	13	12	4	14	10	8	6	2	5	1	9	7	3	12	11	13	15		
Total.....	105	77	115	41	32	54	87	73	58	86	71	32	72	60	117	90	77	90	60	27	74	70	53	74	82	72	30	65	91	125		
TOTAL POSTERIOR ARM LENGTH																																
6.....	15	8	7	5	10	13	3	12	11	2	9	4	1	14	7	6	15	6	10	9	1	14	8	2	11	13	3	4	5	12		
7.....	15	10	5	1	2	14	6	13	12	9	11	3	4	1	15	11	10	11	8	6	1	15	9	7	12	10	15	3	4	12	6	
8.....	14	10	6	2	5	13	12	9	7	8	8	3	4	1	15	9	14	5	13	1	4	11	10	6	15	12	15	4	14	8	6	
9.....	14	13	5	3	4	12	10	11	2	5	7	1	6	15	11	12	13	11	3	1	14	3	10	4	8	10	6	2	15	9	11	
10.....	14	3	13	4	6	1	10	7	5	12	9	2	1	15	5	7	9	10	3	2	12	12	6	3	6	4	15	14	6	11	11	
11.....	13	14	10	4	3	11	12	7	6	2	9	1	4	15	15	4	12	13	3	3	11	5	9	9	10	7	14	15	4	8	8	
12.....	9	6	10	2	3	5	7	11	1	8	12	1	14	13	15	4	12	13	3	11	5	9	9	10	7	14	15	4	10	6	15	3
13.....	13	4	14	7	6	8	10	9	1	5	11	2	3	15	12	10	11	8	1	7	13	12	14	7	14	15	4	10	6	15	3	
14.....	1	15	7	6	9	14	8	10	11	4	5	2	12	13	3	10	3	1	11	5	6	8	7	12	2	13	9	15	14	4	8	
Total.....	108	83	77	33	50	90	78	89	56	58	76	23	57	122	80	96	77	83	40	31	86	69	43	88	97	83	54	71	103	59		

TABLE 55.—The values of  $\chi^2$ , for 4 measurements calculated by ranking the States by the size of the coefficient of variation of these measurements for each age group

Measurement	$\chi^2$ , values <sup>1</sup> for—	
	Boys	Girls
Stature	39.53	40.05
Chest girth at armseye	54.96	48.42
Hip girth	56.87	46.10
Total posterior arm length	54.19	38.50

<sup>1</sup> For 14 degrees of freedom  $\chi^2=23.685$  for the 5-percent level of significance and 29.141 for the 1-percent level of significance.

A statistical analysis based on chi-square<sup>31</sup> was also made to test whether correlations differ significantly among States. Table 56 gives for boys and girls the values of chi-square for 20 correlation coefficients for each of 9 age groups.

Since for the 1-percent level of significance chi-square equals 29.141, only approximately one-third of all the chi-square values given in this table are highly significant. The remaining entries are either not significant or significant only at the 5-percent level.

<sup>31</sup> The test performed was the following: The correlation coefficients shown in tables 41 to 49 were converted into  $z$  values and the quantities  $\chi^2 = \sum (N_i - 3) (z_i - \bar{z})^2$  were calculated for each age and sex. Here  $z_i$  is the transformed correlation of any two measurements for the  $i^{\text{th}}$  State for a given age and sex,  $\bar{z}$  is the weighted mean of 15 such correlations and  $N_i$  is the number in the sample for the  $i^{\text{th}}$  State, for the given age and sex. This quantity is distributed very nearly like chi-square with 14 degrees of freedom.

TABLE 56.—Chi-square<sup>1</sup> values calculated from correlations between measurements obtained in each State for each age group, 6 to 14<sup>2</sup>

Age (years)	BOYS																			
	Hip height—weight	Hip height—chest girth at armseye	Hip height—hip girth	Hip height—total posterior arm length	Hip height—vertical trunk girth	Total posterior arm length—weight	Total posterior arm length—stature	Total posterior arm length—chest girth at armseye	Total posterior arm length—hip girth	Total posterior arm length—vertical trunk girth	Weight—stature	Weight—chest girth at armseye	Weight—hip girth	Weight—vertical trunk girth	Stature—chest girth at armseye	Stature—hip girth	Stature—vertical trunk girth	Chest girth at armseye—hip girth	Chest girth at armseye—vertical trunk girth	Hip girth—vertical trunk girth
6	13.55	11.16	19.16	30.10	27.24	22.55	33.67	17.85	16.04	18.41	21.06	39.60	59.34	47.11	17.21	20.93	33.97	24.07	44.51	17.80
7	35.44	27.87	31.46	43.95	32.93	26.83	44.53	25.72	15.44	21.24	19.43	58.92	75.22	25.49	14.60	16.73	28.89	54.69	22.75	19.29
8	26.31	34.13	22.98	38.19	12.10	17.44	14.70	24.66	9.39	9.40	31.04	32.93	67.65	38.27	32.99	20.41	17.25	39.70	26.54	20.60
9	21.29	21.23	14.83	68.20	25.57	41.05	37.47	39.45	24.53	30.39	16.41	25.26	36.08	16.65	24.95	11.12	21.58	18.44	14.14	12.27
10	19.10	24.42	16.64	67.12	14.60	15.29	33.27	12.48	12.29	13.89	21.95	14.39	41.78	14.74	23.79	21.10	15.21	25.31	10.76	7.52
11	27.15	21.54	21.44	69.01	31.60	28.11	57.03	24.15	22.77	34.34	27.68	36.17	34.66	39.36	16.97	24.53	34.08	25.52	17.46	21.80
12	32.21	14.19	21.49	22.71	31.01	43.42	21.46	17.13	33.29	28.77	45.50	82.06	41.59	62.64	10.76	28.06	24.70	24.44	7.06	15.80
13	23.04	16.54	23.62	33.97	16.75	16.70	19.65	32.32	18.84	13.50	22.69	25.13	64.10	18.22	12.89	21.29	13.86	31.16	13.05	11.46
14	25.45	18.52	26.48	23.66	19.30	46.69	35.52	28.45	30.94	13.00	37.15	30.60	64.94	44.14	24.86	39.75	17.01	31.17	34.59	51.88

Age (years)	GIRLS																			
	Hip height—weight	Hip height—chest girth at armseye	Hip height—hip girth	Hip height—total posterior arm length	Hip height—vertical trunk girth	Total posterior arm length—weight	Total posterior arm length—stature	Total posterior arm length—chest girth at armseye	Total posterior arm length—hip girth	Total posterior arm length—vertical trunk girth	Weight—stature	Weight—chest girth at armseye	Weight—hip girth	Weight—vertical trunk girth	Stature—chest girth at armseye	Stature—hip girth	Stature—vertical trunk girth	Chest girth at armseye—hip girth	Chest girth at armseye—vertical trunk girth	Hip girth—vertical trunk girth
6	39.40	24.42	30.53	80.91	44.85	34.78	74.85	34.45	30.86	27.82	31.78	42.80	40.57	35.23	28.38	26.49	34.20	52.49	24.56	28.88
7	87.88	30.88	35.19	32.43	35.74	21.39	23.58	18.79	17.91	16.65	32.49	40.78	32.78	52.83	27.70	25.61	31.84	18.70	31.22	32.63
8	13.48	13.24	14.83	25.28	28.98	17.93	16.88	21.36	16.74	27.50	13.81	34.00	83.15	25.68	16.62	12.72	27.14	42.01	22.40	23.58
9	27.87	28.99	31.03	28.29	35.99	13.46	22.49	14.89	12.44	15.29	17.69	60.99	43.86	35.70	26.36	15.96	23.61	41.27	28.20	26.72
10	32.76	19.98	22.18	40.58	22.83	31.96	37.43	38.58	31.70	33.46	27.72	19.14	27.39	42.30	26.34	23.53	35.89	17.95	23.09	34.79
11	10.05	10.87	7.68	65.64	19.88	17.13	56.52	18.97	15.66	31.56	8.58	27.23	38.45	30.74	14.58	9.44	22.11	20.77	19.61	23.37
12	8.12	11.66	6.58	17.71	8.65	17.41	26.24	18.98	57.36	23.64	10.37	20.58	36.60	38.14	10.18	8.29	6.50	16.24	27.19	26.76
13	9.84	23.99	14.09	43.90	33.73	11.28	43.63	19.59	46.13	41.25	12.03	53.17	56.30	33.88	15.14	11.00	15.07	41.15	39.76	34.16
14	22.55	13.36	18.58	71.40	20.96	22.29	65.14	22.47	17.54	21.83	32.85	22.25	33.13	36.72	23.64	26.87	17.16	17.51	30.67	43.94

<sup>1</sup> See footnote 31.

<sup>2</sup> For 14 degrees of freedom  $\chi^2=23.685$  for 5-percent level of significance and 29.141 for 1-percent level of significance.

### Measurements of Children of Different Socioeconomic Levels

The children sampled were classified into two socioeconomic groups in order to determine whether the data indicate that socioeconomic differences are significantly associated with body dimensions.

The classification of the socioeconomic groups was at best very rough,<sup>32</sup> since a thorough study of the income and living conditions of the families represented was made impossible by the limitations of funds and W. P. A. regulations. The justification of the brief analysis presented here rests on the consistency of the results obtained.

The general conclusion to be drawn from the study is: Children measured of the lower socioeconomic level are, on the average, smaller with respect to almost

<sup>32</sup> See pp. 21 and 23 for a definition of the two socioeconomic groups and a discussion of the accuracy of classification.

every measurement analyzed than the children measured of the corresponding groups of the higher socioeconomic level. The consistency of the results of the study are striking, although the actual differences may not be.

However, it should be pointed out that although body size differences were found between children divided into the two socioeconomic levels, the basis for classification used need not necessarily have been the sole cause of these differences. To illustrate, it is possible that the children in the lower socioeconomic level might have come predominately from certain racial stocks of small body proportions. If such were the case, the differences observed would more likely be explainable in terms of racial differences than in terms of socioeconomic differences.

The analyses were performed on the means and standard deviations of 19 measurements of children classified by socioeconomic groups, age, and sex.

The age groups considered were 4 to 17 for both boys and girls. In this study the symbols *A* and *B* represent the two levels of socioeconomic groups analyzed. *A* represents the higher and *B* the lower of the income levels.<sup>33</sup>

<sup>33</sup> Children who were not classified in either group *A* or *B* were classified as *C*. This group was not analyzed in this study.

Tables 57 and 58 give the number of cases, the means, and standard deviations of each of 19 measurements for each socioeconomic group, age, and sex. The differences between the means of *A* and *B* for each of the 19 measurements and standard error of the differences between these means were computed and the results given in the same tables.

TABLE 57.—Means and standard deviations (centimeters) for boys, aged 4 to 17, in socioeconomic groups *A* and *B*, differences between the means of these groups, and the standard error of these differences for each of 19 measurements and each age group

Measurement	Age 4					Age 5					Age 6							
	Group <i>A</i>		Group <i>B</i>		Differ-ence of means	Stand-ard error of differ-ence of means	Group <i>A</i>		Group <i>B</i>		Differ-ence of means	Stand-ard error of differ-ence of means	Group <i>A</i>		Group <i>B</i>		Differ-ence of means	Stand-ard error of differ-ence of means
	Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.		
Waist height	63.15	3.75	61.68	3.93	1.47	0.28	68.04	3.89	66.77	4.10	1.27	0.17	72.34	4.04	71.06	3.93	1.28	0.12
Hip height	50.02	3.27	48.90	3.39	1.12	.24	54.24	3.33	53.25	3.45	.99	.15	57.91	3.42	56.88	3.36	1.03	.11
Weight	39.54	5.16	38.02	4.52	1.52	.36	43.99	5.75	42.36	5.83	1.63	.25	48.61	6.55	46.91	6.14	1.70	.20
Stature	106.16	5.25	104.32	5.34	1.84	.38	112.73	5.29	111.07	5.69	1.66	.24	118.62	5.43	116.96	5.43	1.66	.17
Cervicale height	86.88	4.55	85.25	4.88	1.63	.34	92.95	4.75	91.48	5.16	1.47	.54	98.19	4.87	96.79	4.86	1.40	.15
Tibiale height	27.56	1.85	26.93	1.96	.63	.14	29.77	2.05	29.23	2.06	.54	.09	31.62	2.01	31.12	1.99	.50	.04
Bitrochanteric diameter	19.92	1.18	19.52	1.09	.40	.08	20.70	1.26	20.40	1.24	.30	.05	21.46	1.21	21.12	1.22	.34	.06
Chest girth at armscye	56.87	2.89	56.43	2.81	.44	.21	58.66	2.93	58.13	2.93	.53	.13	60.48	3.12	59.99	2.98	.49	.10
Waist girth	51.69	3.21	51.54	2.87	.15	.22	52.81	2.89	52.39	2.98	.42	.13	53.82	3.11	53.50	2.94	.32	.09
Hip girth	56.54	3.40	55.46	3.04	1.08	.24	58.69	3.52	57.74	3.64	.95	.15	60.84	3.85	59.81	3.47	1.03	.11
Neck-hase girth	27.75	1.52	27.76	1.55	-.01	.11	28.76	1.55	28.70	1.53	.06	.07	29.35	1.48	30.18	1.43	-.83	.05
Armscye girth	25.74	1.74	25.46	1.68	.28	.13	26.82	1.77	26.51	1.87	.31	.08	27.65	1.79	27.38	1.73	.27	.06
Upper-arm girth	16.75	1.27	16.49	1.17	.26	.09	17.13	1.31	16.85	1.27	.28	.06	17.42	1.42	17.14	1.31	.28	.04
Total posterior arm length	37.07	2.25	36.23	2.34	.84	.17	39.51	2.29	38.83	2.37	.68	.10	41.67	2.39	41.08	2.37	.59	.07
Thigh girth	32.23	2.53	31.46	2.29	.77	.18	33.50	2.74	32.63	2.67	.87	.12	34.53	2.86	33.75	2.59	.78	.09
Maximum calf girth	22.00	1.45	21.61	1.36	.39	.10	22.81	1.57	22.40	1.58	.41	.07	23.63	1.61	23.27	1.54	.36	.05
Knee girth	23.37	1.51	23.04	1.30	.33	.10	24.22	1.47	23.83	1.52	.39	.06	25.12	1.56	24.79	1.51	.33	.05
Total crotch length	45.59	2.90	45.24	2.80	.35	.21	47.57	3.10	46.76	3.13	.81	.13	49.40	3.24	48.59	3.11	.81	.10
Vertical trunk girth	97.26	4.54	96.28	4.50	.98	.33	101.20	4.72	100.03	4.98	1.17	.21	105.03	4.91	103.84	4.80	1.19	.15
Number of cases	306		492				1,074		1,060				2,071		2,011			
Age 7																		
Waist height	76.46	4.11	75.19	4.23	1.27	0.12	80.32	4.62	79.13	4.47	1.19	0.12	84.29	4.77	82.86	4.66	1.43	0.12
Hip height	61.27	3.54	60.42	3.63	.85	.10	64.77	3.96	63.80	3.81	.97	.10	68.17	4.09	67.03	4.01	1.14	.10
Weight	53.59	7.30	51.78	6.79	1.81	.20	59.52	9.04	57.22	8.26	2.30	.23	65.73	10.11	63.01	9.15	2.72	.25
Stature	123.96	5.47	122.63	5.66	1.33	.16	129.51	6.09	127.94	5.94	1.57	.16	134.71	6.23	132.98	6.13	1.73	.16
Cervicale height	102.98	4.99	101.84	5.09	1.14	.14	107.99	5.59	106.69	5.41	1.30	.15	112.83	5.80	111.27	5.71	1.56	.15
Tibiale height	33.42	2.09	33.00	2.12	.42	.06	35.21	2.31	34.77	2.22	.44	.06	36.95	2.38	36.40	2.29	.55	.06
Bitrochanteric diameter	22.24	1.38	21.97	1.33	.27	.04	23.20	1.56	22.85	1.47	.35	.04	24.12	1.68	23.77	1.25	.35	.04
Chest girth at armscye	62.58	3.39	61.95	3.15	.63	.09	64.85	3.81	64.11	3.47	.74	.10	67.06	4.03	66.27	3.71	.79	.10
Waist girth	55.02	3.33	54.70	2.95	.32	.09	56.48	3.69	56.06	3.33	.42	.09	57.93	4.02	57.43	3.61	.50	.10
Hip girth	63.11	4.10	62.07	3.68	1.04	.11	65.74	4.56	64.52	4.23	1.22	.12	68.37	4.96	67.06	4.43	1.31	.12
Neck-hase girth	30.12	1.48	29.95	1.49	.17	.04	30.89	1.60	30.70	1.53	.19	.04	31.64	1.62	31.43	1.59	.21	.04
Armscye girth	28.85	1.88	28.53	1.80	.32	.05	30.06	2.05	29.69	1.95	.37	.05	31.33	2.16	30.86	1.98	.47	.05
Upper-arm girth	17.96	1.51	17.61	1.37	.35	.04	18.61	1.72	18.16	1.55	.45	.04	19.29	1.85	18.81	1.62	.48	.04
Total posterior arm length	43.85	2.42	43.28	2.49	.57	.07	46.08	2.68	45.41	2.61	.67	.07	48.26	2.82	47.49	2.71	.77	.07
Thigh girth	35.90	3.08	35.06	2.78	.84	.08	37.50	3.53	36.50	3.23	1.00	.09	39.25	3.80	38.13	3.42	1.12	.09
Maximum calf girth	24.56	1.71	24.12	1.60	.44	.05	25.49	1.91	25.00	1.84	.49	.05	26.48	1.97	26.00	1.86	.48	.05
Knee girth	26.10	1.66	25.74	1.55	.36	.05	27.14	1.83	26.76	1.77	.38	.05	28.21	1.93	27.77	1.84	.44	.05
Total crotch length	51.00	3.33	50.43	3.16	.57	.09	53.16	3.58	52.28	3.45	.88	.09	55.20	3.85	54.20	3.67	1.00	.10
Vertical trunk girth	108.53	4.95	107.62	4.94	.91	.14	112.45	5.58	111.29	5.33	1.16	.14	116.26	5.82	115.00	5.54	1.26	.15
Number of cases	2,466		2,544				2,741		3,019				3,003		3,096			
Age 8																		
Waist height	87.89	4.90	86.45	4.83	1.44	0.12	91.10	5.11	89.97	5.12	1.13	0.13	95.06	5.55	93.54	5.29	1.52	0.13
Hip height	71.30	4.17	70.11	4.15	1.19	.10	74.05	5.39	73.13	4.43	.92	.11	77.56	4.80	76.26	4.59	1.30	.12
Weight	72.27	11.97	68.62	10.69	3.65	.28	78.63	13.50	75.05	12.10	3.58	.32	87.12	16.11	82.40	14.22	4.72	.38
Stature	139.47	6.40	137.59	6.34	1.88	.16	143.71	6.78	142.30	6.68	1.41	.17	149.07	7.53	147.16	7.21	1.91	.18
Cervicale height	117.35	6.02	115.68	5.94	1.67	.15	121.36	6.33	120.08	6.32	1.28	.16	126.42	7.07	124.70	6.77	1.72	.17
Tibiale height	38.63	2.49	37.98	2.42	.65	.06	40.08	2.56	39.62	2.58	.46	.06	41.91	2.81	41.29	2.60	.62	.07
Bitrochanteric diameter	25.09	1.83	24.60	1.68	.49	.04	26.02	1.93	25.53	1.78	.49	.05	27.13	2.17	26.55	1.95	.58	.05
Chest girth at armscye	69.40	4.53	68.23	4.09	1.17	.11	71.53	4.85	70.48	4.33	1.05	.12	74.18	5.35	72.85	4.88	1.33	.13
Waist girth	59.37	4.51	58.71	4.01	.66	.11	60.91	4.84	60.18	4.37	.73	.12	62.68	5.31	61.71	4.73	.97	.12
Hip girth	71.02	5.47	69.33	4.89	1.69	.13	73.44	5.76	71.83	5.24	1.61	.14	76.47	6.32	74.54	5.58	1.93	.15
Neck-hase girth	32.28	1.71	32.05	1.66	.23	.04	32.95	1.76	32.71	1.72	.24	.04	33.85	1.95	33.48	1.85	.37	.05
Armscye girth	32.50	2.32	30.90	2.06	1.60	.11	33.67	2.43	33.08	2.25	.59	.06	35.09	2.74	34.34	2.50	.75	.07
Upper-arm girth	20.04	2.09	19.39	1.83	.65	.05	20.71	2.20	20.08	1.94	.63	.05	21.49	2.36	20.84	2.13	.65	.06
Total posterior arm length	50.23	2.93	49.46	2.87	.77	.07	52.06	3.05	51.44	3.00	.62	.08	54.44	3.34	53.47	3.18	.97	.08
Thigh girth	40.96	4.28	39.51	3.77	1.45	.10	42.50	4.50	41.14	4.01	1.36	.11	44.29	4.75	42.70	4.22	1.59	.11
Maximum calf girth	27.50	2.16	26.83	2.02	.67	.05	28.40	2.29	27.76	2.18	.64	.06	29.53	2.55	28.84	2.39	.69	.06
Knee girth	29.31	2.10	28.67	1.98	.64	.05	30.25	2.21	29.72	2.10	.53	.05	32.48	2.47	30.86	2.26	1.62	.06
Total crotch length	57.03	4.04	55.92	3.78	1.11	.10	58.84	4.34	57.74	4.08	1.10	.11	61.30	4.79	59.90	4.44	1.40	.11
Vertical trunk girth	119.84	6.26	118.34	6.07	1.50	.15	123.36	6.90	122.02	6.50	1.34	.17	128.12	7.72	126.10	7.40	2.02	.19
Number of cases	3,230		3,258				3,234		3,112				3,466		2,992			

TABLE 57.—Means and standard deviations (centimeters) for boys, aged 4 to 17, in socioeconomic groups A and B, differences between the means of these groups, and the standard error of these differences for each of 19 measurements and each age group—Continued

Measurement	Age 13						Age 14						Age 15					
	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means
	Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.		
Waist height.....	99.06	5.76	97.45	5.68	1.61	0.15	102.93	5.76	101.30	5.81	1.63	0.17	107.23	5.30	105.96	5.65	1.27	0.17
Hip height.....	81.00	4.99	79.60	4.92	1.40	.13	84.15	4.90	82.82	5.00	1.33	.15	87.88	4.52	86.81	4.79	1.07	.14
Weight.....	97.40	18.17	92.32	17.07	5.08	.45	109.48	20.06	103.67	19.06	5.81	.58	125.73	20.41	120.09	19.56	5.64	.61
Stature.....	155.06	8.42	152.96	8.14	2.10	.21	161.28	8.60	159.04	8.67	2.24	.26	168.61	7.71	166.69	8.25	1.92	.25
Cervicale height.....	131.93	7.79	130.03	7.52	1.90	.20	137.62	7.91	135.60	7.98	2.02	.24	144.28	7.10	142.56	7.53	1.72	.23
Tibiale height.....	43.73	2.93	43.08	2.94	.65	.08	45.41	2.88	44.73	2.88	.68	.09	47.32	2.62	46.70	2.76	.62	.08
Bitrochanteric diameter.....	28.36	2.25	27.78	2.16	.58	.06	29.82	2.40	29.17	2.32	.65	.07	31.43	2.11	30.92	2.19	.51	.07
Chest girth at armscye.....	77.29	5.77	75.92	5.46	1.37	.14	80.98	6.22	79.30	6.02	1.68	.18	86.17	6.17	84.75	6.00	1.42	.19
Waist girth.....	64.51	5.18	63.57	4.86	.94	.13	66.61	5.33	65.68	4.88	.93	.15	69.30	5.58	68.24	4.90	1.06	.16
Hip girth.....	79.67	6.42	77.83	6.15	1.84	.16	83.34	6.65	81.36	6.32	1.98	.19	87.77	6.23	86.04	6.02	1.73	.19
Neck-base girth.....	35.02	2.24	34.58	2.14	.44	.06	36.42	2.41	35.85	2.39	.57	.07	39.08	2.47	38.45	2.51	.63	.08
Armscye girth.....	36.84	3.04	36.07	2.85	.77	.08	38.80	3.18	37.94	3.13	.86	.09	40.74	2.88	39.97	2.93	.77	.09
Upper-arm girth.....	22.44	2.43	21.81	2.28	.63	.06	23.52	2.52	22.87	2.39	.65	.07	25.16	2.46	24.64	2.39	.52	.07
Total posterior arm length.....	56.83	3.55	55.82	3.48	1.01	.09	59.31	3.65	58.30	3.65	1.01	.11	62.16	3.42	61.33	3.52	.83	.11
Thigh girth.....	46.00	4.71	44.51	4.42	1.49	.12	47.82	4.75	46.24	4.39	1.58	.13	50.15	4.54	48.98	4.28	1.17	.13
Maximum calf girth.....	30.82	2.66	30.16	2.60	.66	.07	32.22	2.71	31.41	2.66	.81	.08	33.81	2.50	33.22	2.53	.59	.08
Knee girth.....	32.70	2.47	32.13	2.41	.57	.06	33.85	2.39	33.24	2.36	.61	.07	35.05	2.14	34.60	2.12	.45	.07
Total crotch length.....	64.10	5.13	62.78	5.12	1.32	.13	67.22	5.20	65.79	5.28	1.43	.16	70.88	4.84	69.62	4.91	1.26	.15
Vertical trunk girth.....	134.02	9.14	131.78	8.71	2.24	.23	140.65	9.60	138.18	9.77	2.47	.29	148.33	8.76	146.11	9.05	2.22	.27
Number of cases.....	3,430		2,684				2,664		1,997				2,808		1,727			
Measurement	Age 16						Age 17											
	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means
	Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.		
Waist height.....	109.03	5.15	108.23	5.20	0.80	0.17	109.88	4.98	109.22	5.07	0.66	0.21	111.88	4.84	111.18	4.98	0.70	.21
Hip height.....	89.24	4.42	88.54	4.48	.70	.15	89.81	4.36	89.18	4.31	.63	.18	91.88	4.28	91.18	4.31	.70	.18
Weight.....	134.84	19.41	130.41	18.78	4.43	.64	140.27	18.84	137.39	17.98	2.88	.75	146.84	19.18	143.91	18.28	2.93	.75
Stature.....	172.30	6.45	170.94	7.13	1.36	.23	174.20	6.45	173.04	6.55	1.16	.27	176.84	6.19	175.65	6.19	1.19	.27
Cervicale height.....	147.55	6.50	146.39	6.60	1.16	.22	149.32	6.04	148.19	6.19	1.13	.25	151.88	5.84	150.74	5.84	1.14	.25
Tibiale height.....	48.02	2.59	47.58	2.60	.44	.09	48.40	2.50	47.85	2.47	.55	.10	50.15	2.47	49.60	2.47	.55	.10
Bitrochanteric diameter.....	32.40	1.90	31.95	1.93	.45	.06	32.84	1.78	32.65	1.72	.19	.07	34.32	1.72	33.87	1.72	.45	.07
Chest girth at armscye.....	89.11	5.86	88.00	5.73	1.11	.19	91.19	5.49	90.31	5.44	.88	.22	93.18	5.44	92.31	5.44	.87	.22
Waist girth.....	70.82	5.34	70.12	5.12	.70	.17	71.99	5.28	71.51	5.07	.48	.21	73.18	5.07	72.69	5.07	.49	.21
Hip girth.....	90.31	5.66	88.96	5.43	1.35	.18	91.73	5.39	90.79	4.98	.94	.21	93.18	5.18	92.21	5.18	.97	.21
Neck-base girth.....	40.20	2.28	39.66	2.21	.54	.07	40.92	2.15	40.56	2.16	.36	.09	42.42	2.16	41.96	2.16	.46	.09
Armscye girth.....	42.15	2.65	41.69	2.68	.46	.09	43.03	2.58	42.88	2.71	.15	.11	44.52	2.58	44.06	2.58	.46	.11
Upper-arm girth.....	26.15	2.39	25.76	2.35	.39	.08	26.87	2.39	26.69	2.22	.18	.09	28.37	2.39	27.98	2.39	.39	.09
Total posterior arm length.....	63.60	4.67	63.01	3.16	.59	.13	64.27	3.03	63.90	3.08	.37	.12	65.84	3.08	65.47	3.08	.37	.12
Thigh girth.....	51.51	4.46	50.62	4.23	.89	.14	52.30	4.41	51.77	4.05	.53	.17	53.78	4.05	53.31	4.05	.47	.17
Maximum calf girth.....	34.63	2.41	34.15	2.39	.48	.08	35.13	2.45	34.81	2.38	.32	.10	36.63	2.45	36.16	2.45	.47	.10
Knee girth.....	35.56	2.12	35.13	2.02	.43	.07	35.78	2.05	35.42	1.94	.36	.08	37.28	2.05	36.92	2.05	.36	.08
Total crotch length.....	72.63	4.38	71.70	4.22	.93	.14	73.65	4.16	72.83	4.08	.82	.17	74.65	4.08	73.83	4.08	.82	.17
Vertical trunk girth.....	152.82	7.78	151.32	7.72	1.50	.26	155.61	6.83	154.61	6.93	1.00	.28	158.40	6.93	157.40	6.93	1.00	.28
Number of cases.....	2,534		1,372				1,802		899									

TABLE 58.—Means and standard deviations (centimeters) for girls, aged 4 to 17, in socioeconomic groups A and B, differences between the means of these groups, and the standard error of these differences for each of 19 measurements and each age group

Measurement	Age 4						Age 5						Age 6					
	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-ference of means
	Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.		
Waist height.....	63.46	3.71	62.12	3.94	1.34	0.25	68.44	3.90	66.86	4.00	1.58	0.16	72.41	4.02	71.37	4.15	1.04	0.12
Hip height.....	50.22	3.22	49.18	3.45	1.04	.22	54.49	3.32	53.20	3.49	1.29	.13	57.96	3.45	57.09	3.51	.87	.10
Weight.....	38.36	5.08	36.91	4.74	1.45	.32	42.95	6.18	40.81	5.64	2.14	.23	47.18	7.02	45.73	6.64	1.45	.20
Stature.....	105.52	4.78	103.64	5.32	1.88	.33	111.89	5.32	109.93	5.47	1.96	.21	117.44	5.42	116.18	5.55	1.26	.16
Cervicale height.....	86.75	4.44	85.12	4.79	1.63	.30	92.68	4.77	90.85	4.95	1.83	.19	97.65	4.90	96.52	4.97	1.13	.15
Tibiale height.....	27.70	1.83	27.11	2.00	.59	.12	29.95	1.98	29.21	2.04	.74	.08	31.78	2.06	31.31	2.18	.47	.06
Bitrochanteric diameter.....	19.93	1.24	19.54	1.21	.39	.08	20.75	1.38	20.32	1.31	.43	.05	21.57	1.49	21.26	1.42	.31	.04
Chest girth at armscye.....	55.84	2.87	55.24	2.70	.60	.18	57.54	3.08	56.81	2.98	.73	.12	59.26	3.37	58.68	3.19	.58	.10
Waist girth.....	50.38	3.00	50.10	2.77	.28	.19	51.52	3.22	50.71	2.97	.81	.12	52.29	3.55	51.81	3.25	.48	.10
Hip girth.....	56.80	3.62	55.82	3.38	.98	.23	59.32	3.96	57.89	3.57	1.43	.15	61.36	4.25	60.43	4.08	.93	.12
Neck-base girth.....	27.29	1.52	27.11	1.52	.18	.10	28.17	1.47	27.88	1.49	.29	.06	28.73	1.60	28.51	1.47	.22	.05
Armscye girth.....	25.11	1.69	24.90	1.79	.21	.11	26.23	1.77	25.73	1.71	.50	.07	26.83	1.88	26.64	1.80	.19	.05
Upper-arm girth.....	16.64	1.34	16.41	1.24	.23	.09	17.21	1.44	16.70	1.28	.51	.05	17.40	1.52	17.10	1.41	.30	.04
Total posterior arm length.....	36.49	2.22	35.90	2.25	.59	.15	38.90	2.30	38.17	2.36	.73	.09	40.96	2.37	40.52	2.43	.44	.07
Thigh girth.....	32.92	2.78	32.21	2.59	.71	.18	34.32	3.01	33.35	2.71	.97	.11	35.37	3.17	34.69	3.01	.68	.09
Maximum calf girth.....	22.15	1.43	21.73	1.42	.42	.09	22.97	1.63	22.49	1.56	.48	.06	23.76	1.76	23.48	1.78	.28	.05
Knee girth.....	23.21	1.50	22.82	1.40	.39	.10	24.07	1.63	23.60	1.53	.47	.06	24.93	1.81	24.64	1.62	.29	.05
Total crotch length.....	45.65	2.84	45.08	2.82	.57													

TABLE 58.—Means and standard deviations (centimeters) for girls, aged 4 to 17, in socioeconomic groups A and B, differences between the means of these groups, and the standard error of these differences for each of 19 measurements and each age group—Continued

Measurement	Age 7						Age 8						Age 9					
	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-fer-ence of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-fer-ence of means	Group A		Group B		Dif-fer-ence of means	Stand-ard error of dif-fer-ence of means
	Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.			Mean	S. D.	Mean	S. D.		
Waist height	76.59	4.28	75.36	4.27	1.23	0.12	80.71	4.72	79.46	4.47	1.25	0.12	84.41	4.77	83.23	4.77	1.18	0.17
Hip height	61.46	3.66	60.44	3.68	1.02	.10	64.94	3.94	63.92	3.84	1.02	.10	68.04	4.07	67.03	4.05	1.01	.14
Weight	52.65	8.35	50.60	7.56	2.05	.22	58.46	10.00	55.92	8.62	2.54	.25	64.41	11.41	61.77	10.51	2.64	.29
Stature	122.98	5.65	121.53	5.64	1.45	.16	128.49	6.17	127.03	5.85	1.46	.16	133.36	6.26	131.97	6.23	1.39	.24
Cervicale height	102.55	5.12	101.33	5.13	1.22	.14	107.58	5.70	106.28	5.39	1.30	.15	112.15	5.86	110.92	5.85	1.23	.21
Tibiale height	33.65	2.17	33.04	2.11	.61	.06	35.47	2.31	34.87	2.21	.60	.06	37.07	2.37	36.49	2.40	.58	.08
Bitrochanteric diameter	22.50	1.62	22.10	1.50	.40	.04	23.43	1.79	23.02	1.55	.41	.04	24.37	1.87	23.97	1.82	.40	.06
Chest girth at armscye	61.38	3.69	60.66	3.48	.72	.10	63.57	4.29	62.69	3.71	.88	.11	65.77	4.61	64.82	4.30	.95	.14
Waist girth	53.72	3.84	52.97	3.50	.75	.10	55.14	4.34	54.27	3.83	.87	.11	56.56	4.71	55.80	4.30	.76	.14
Hip girth	64.11	4.71	62.84	4.40	1.27	.13	66.79	5.27	65.34	4.60	1.45	.13	69.47	5.64	68.09	5.31	1.38	.15
Neck-base girth	29.42	1.56	29.18	1.52	.24	.04	30.22	1.64	29.87	1.56	.35	.04	30.92	1.70	30.62	1.69	.30	.06
Armscye girth	27.94	1.96	27.61	1.85	.33	.05	29.10	2.15	28.70	1.98	.40	.06	30.10	2.29	29.73	2.17	.37	.07
Upper-arm girth	18.03	1.71	17.58	1.57	.45	.05	18.66	1.92	18.21	1.68	.45	.05	19.35	2.12	18.87	1.91	.48	.05
Total posterior arm length	43.20	2.44	42.59	2.48	.61	.07	45.50	2.68	44.82	2.63	.68	.07	47.54	2.80	46.88	2.76	.66	.10
Thigh girth	37.09	3.58	36.10	3.30	.99	.10	38.77	3.96	37.60	3.50	1.17	.10	40.42	4.28	39.27	3.99	1.15	.12
Maximum calf girth	24.76	1.87	24.32	1.73	.44	.05	25.65	2.01	25.23	1.79	.42	.05	26.61	2.15	26.12	2.02	.49	.06
Knee girth	26.02	1.84	25.58	1.70	.44	.05	27.08	1.97	26.58	1.75	.50	.05	28.11	2.13	27.63	2.01	.48	.06
Total crotch length	51.56	3.68	50.73	3.55	.83	.10	53.72	4.06	52.77	3.93	.95	.11	55.91	4.33	54.98	4.06	.93	.13
Vertical trunk girth	106.60	5.32	105.52	5.12	1.08	.14	110.45	6.01	109.28	5.50	1.17	.15	114.20	6.32	113.15	6.04	1.05	.22
Number of cases	2,464		2,838				2,713		2,956				2,976		3,124			
	Age 10						Age 11						Age 12					
Waist height	88.60	4.93	87.42	4.98	1.18	0.13	92.80	5.32	91.49	5.26	1.31	0.14	96.84	5.14	95.40	5.25	1.44	0.14
Hip height	71.47	4.16	70.55	4.22	.92	.11	74.90	4.43	73.90	4.47	1.00	.11	78.13	4.33	76.99	4.43	1.14	.12
Weight	71.78	13.42	68.79	12.28	2.99	.33	80.62	15.57	77.05	14.20	3.57	.38	90.93	16.92	87.18	16.86	3.75	.45
Stature	138.90	6.57	137.57	6.65	1.33	.17	144.96	7.33	143.30	7.33	1.66	.19	151.07	7.31	149.18	7.48	1.89	.20
Cervicale height	117.35	6.23	116.19	6.24	1.16	.16	123.02	6.84	121.57	6.76	1.45	.18	128.68	6.81	126.99	6.97	1.69	.18
Tibiale height	38.90	2.47	38.35	2.42	.55	.06	40.73	2.61	40.18	2.67	.55	.07	42.44	2.54	41.78	2.54	.66	.07
Bitrochanteric diameter	25.54	2.08	25.12	1.96	.42	.05	26.95	2.33	26.41	2.20	.54	.06	28.62	2.47	28.10	2.49	.52	.07
Chest girth at armscye	68.29	5.25	67.29	4.84	1.00	.13	71.26	5.61	70.15	5.15	1.11	.14	74.53	5.81	73.45	5.80	1.08	.15
Waist girth	58.26	5.13	57.34	4.75	.92	.13	59.97	5.33	59.16	4.90	.81	.13	61.61	5.20	61.10	5.26	.51	.14
Hip girth	72.67	6.22	71.19	5.83	1.48	.15	76.39	6.82	74.74	6.40	1.65	.17	80.78	7.12	79.12	7.17	1.66	.19
Neck-base girth	31.73	1.80	31.42	1.78	.31	.05	32.70	1.94	32.36	1.88	.34	.05	33.87	1.96	33.46	1.96	.41	.05
Armscye girth	31.45	2.48	30.97	2.29	.48	.06	32.80	2.62	32.32	2.44	.48	.07	34.22	2.66	33.77	2.61	.45	.07
Upper-arm girth	20.15	2.28	19.62	2.12	.53	.06	20.91	2.35	20.39	2.20	.52	.06	21.72	2.43	21.25	2.38	.47	.06
Total posterior arm length	49.84	2.95	49.26	2.93	.58	.08	52.33	3.19	51.69	3.17	.64	.08	54.85	3.17	53.99	3.21	.86	.08
Thigh girth	41.64	8.85	41.08	4.32	.56	.18	44.30	4.93	43.06	4.54	1.24	.12	46.57	5.05	45.29	5.00	1.28	.13
Maximum calf girth	27.66	2.35	27.17	2.19	.49	.06	28.77	2.43	28.34	2.34	.43	.06	30.06	2.54	29.56	2.51	.50	.07
Knee girth	29.29	2.32	28.80	2.17	.49	.06	30.56	2.42	29.99	1.77	.57	.05	31.82	2.42	31.31	2.38	.51	.06
Total crotch length	58.29	4.53	57.28	4.27	1.01	.11	60.77	4.90	59.65	4.56	1.12	.12	63.50	5.01	62.34	4.96	1.16	.13
Vertical trunk girth	118.88	6.90	117.57	6.75	1.31	.17	124.13	7.74	122.51	7.56	1.62	.20	129.85	7.97	128.28	8.19	1.57	.21
Number of cases	2,967		3,179				2,976		3,040				3,062		2,714			
	Age 13						Age 14						Age 15					
Waist height	99.63	4.63	98.56	4.77	1.07	0.13	101.27	4.42	100.36	4.46	0.91	0.15	102.22	4.35	102.00	4.45	0.22	0.15
Hip height	80.27	4.12	79.38	4.13	.89	.12	81.27	4.12	80.60	4.00	.67	.14	82.30	4.00	82.09	4.12	.21	.14
Weight	100.79	17.20	96.75	16.86	4.04	.48	107.53	15.86	104.66	15.97	2.87	.53	114.97	15.68	112.99	14.54	1.98	.50
Stature	155.64	6.60	154.26	6.83	1.38	.18	158.46	6.08	157.29	6.17	1.17	.21	160.68	5.78	160.28	5.86	.40	.20
Cervicale height	132.93	6.14	131.69	6.35	1.24	.18	135.57	5.69	134.54	5.73	1.03	.19	137.42	5.39	137.17	5.43	.25	.18
Tibiale height	43.53	2.37	43.06	2.48	.47	.07	44.03	2.37	43.62	2.33	.41	.08	44.41	2.30	44.28	2.31	.13	.08
Bitrochanteric diameter	30.21	2.41	29.73	2.45	.48	.07	31.35	2.17	30.98	2.19	.37	.07	32.22	1.93	32.09	1.86	.13	.06
Chest girth at armscye	77.42	5.56	76.37	5.62	1.05	.14	79.30	5.16	78.79	5.21	.51	.17	82.23	4.86	81.54	4.77	.69	.16
Waist girth	63.98	5.04	62.49	4.96	1.49	.14	63.77	4.81	63.64	4.91	.13	.16	64.86	4.68	64.22	4.44	.64	.14
Hip girth	85.10	7.02	83.42	7.10	1.68	.20	88.18	6.17	86.96	6.38	1.22	.21	91.06	5.62	90.41	5.38	.65	.18
Neck-base girth	34.86	1.93	34.46	1.93	.40	.05	35.45	1.70	35.15	1.82	.30	.06	36.41	1.62	36.27	1.66	.14	.06
Armscye girth	35.53	2.64	35.13	2.61	.40	.07	36.47	2.45	36.22	2.55	.25	.08	37.34	2.14	37.21	2.14	.13	.07
Upper-arm girth	22.64	2.44	22.12	2.39	.52	.07	23.32	2.37	23.02	2.38	.30	.08	24.52	2.25	24.13	2.15	.39	.07
Total posterior arm length	56.64	2.97	55.98	2.96	.66	.08	57.65	2.83	57.23	2.45	.42	.09	58.72	2.73	58.53	2.79	.19	.09
Thigh girth	48.91	5.16	47.58	5.14	1.32	.15	50.70	4.70	49.70	4.94	1.00	.16	52.64	4.42	51.99	4.32	.65	.15
Maximum calf girth	31.27	2.54	30.71	2.51	.56	.07	32.09	2.40	31.67	2.41	.42	.08	32.88	2.24	32.60	2.15	.28	.07
Knee girth	32.89	2.39	32.27	2.32	.62	.07	33.51	2.25	32.98	3.01	.53	.09	33.87	2.12	33.69	2.05	.18	.07
Total crotch length	66.03	4.91	64.77	4.84	1.26	.14	67.74	4.40	66.71	4.48	1.03	.15	69.64	4.03	69.33	3.91	.31	.13
Vertical trunk girth	135.03	7.58	133.39	7.72	1.64	.22	138.66	6.76	137.43	7.04	1.23	.23	141.63	6.22	141.56	5.99	.07	.20
Number of cases	2,696		2,361				1,936		1,653				2,428		1,414			
	Age 16						Age 17											
Waist height	102.31	4.44	102.08	4.39	0.24	0.16	102.12	4.53	102.30	4.64	-0.18	0.22						
Hip height	82.31	4.07	82.04	4.03	.27	.15	82.19	4.14	82.22	4.13	-.03	.20						
Weight	117.11	14.54	115.90	15.18	1.21	.55	117.65	14.98	116.89	14.61	.76	.70						
Stature	161.21	5.82	160.85	5.72	.36	.21	161.10	5.91	161.19	6.05	-.09	.29						
Cervicale height	137.88	5.46	137.52	5.43	.36	.20	137.76	5.59	137.94	5.73	-.18	.27						
Tibiale height	44.42	2.36	44.23	2.30	.19	.09	44.34	2.37	44.27	2.36	.07	.11						
Bitrochanteric diameter	32.55	1.77	32.54	1.92	.01	.07	32.71	1.87	32.74	2.00	-.03	.09						
Chest girth at armscye	82.85	4.70	82.34	4.67	.51	.17	83.04	4.76	82.59	4.66	.45	.22						
Waist girth	64.51	4.55	64.60	4.76	-.09	.17	64.49	4.60	64.76	4.62	-.27	.22						
Hip girth	92.02	5.05	91.67	5.37	.35	.19	92.40	5.28	92.24	5.35	.16	.25						

The obvious conclusion to be drawn from these tables is that the means of each of the 19 measurements, with very few exceptions, are larger for group *A* than for group *B* for each age group and each sex. The statistical significance of this conclusion follows from the fact that the probability is negligible<sup>34</sup> of getting, by chance, as many positive signs in the mean differences between socioeconomic groups *A* and *B* for a given measurement as were obtained in the different age groups.

A graphic representation of differences between the means of five important measurements for children of socioeconomic groups *A* and *B* is given in figures 57 and 58.

An analysis was next made to test whether the variances and covariances of the four measurements—stature, total posterior arm length, chest girth, and hip girth—for the children of the two socioeconomic groups are the same when the means of these measurements are not taken into consideration. To this end, the Lambda ( $\lambda$ ) criterion (11) was calculated for each age and sex. The results of this analysis are given in table 59. Columns 3 and 5 of this table give the values of chi-square =  $-2 \log_e \lambda$ <sup>35</sup> for each age. A study of these results indicates that, with few exceptions, the variances and covariances of the four measurements sampled from the two socioeconomic groups are significantly different.

TABLE 59.— $\lambda$  criteria for testing the hypothesis that 4 measurements—stature, total posterior arm length, chest girth, and hip girth—of children of a given age of socioeconomic groups *A* and *B* come from a population having the same variances and covariances

Age (years)	Boys		Girls	
	log <sub>e</sub> λ	chi-square <sup>1</sup>	log <sub>e</sub> λ	chi-square <sup>1</sup>
4	-7.51	15.02	-10.97	21.95
5	-4.66	9.31	-17.13	34.25
6	-25.11	50.23	-13.23	26.47
7	-38.35	76.70	-10.86	21.72
8	-23.78	47.56	-46.06	92.12
9	-36.42	72.83	-17.96	35.91
10	-41.11	82.22	-22.94	45.88
11	-47.04	94.07	-25.10	50.19
12	-21.87	43.75	-9.55	19.09
13	-19.30	38.59	-13.52	27.03
14	-21.56	43.11	-74.00	148.00
15	-17.26	34.51	-10.34	20.68
16	-35.54	71.09	-6.00	11.99
17	-10.08	20.16	-4.25	8.49

<sup>1</sup> For 10 degrees of freedom  $\chi^2=18.307$  for the 5-percent level of significance and 23.209 for the 1-percent level of significance.

Because of the popular and scientific interest in the relationship between height and weight, regression

<sup>34</sup> The application of a more sensitive statistical test (Hotelling's generalized *T* (4)) in general, substantiated the above results. It showed that the sets of means of the measurements between the socioeconomic groups differ significantly within most age groups.

<sup>35</sup> For large samples these quantities are distributed like  $\chi^2$  with 10 degrees of freedom (12). For 10 degrees of freedom  $\chi^2=18.307$  for the 5-percent level of significance and 23,209 for the 1 percent level of significance.

equations of the natural logarithm of weight on height were calculated for each age, sex, and socioeconomic group classification. The ages ranged from 4 to 14 for boys and 4 to 11 for girls. The regression equations are given in table 60, together with the variances calculated from the deviations from regression. In order to test whether the coefficients of these equations calculated for socioeconomic group *A* are significantly different from those of group *B*, "Student's" *t* test was applied. The values of *t* are also given in table 60.

TABLE 60.—Regressions of logarithm of weight on stature for age-sex-socioeconomic group classifications together with the variances calculated from the residuals, *t* values for the coefficients of regressions, and number of cases on which the calculations were based

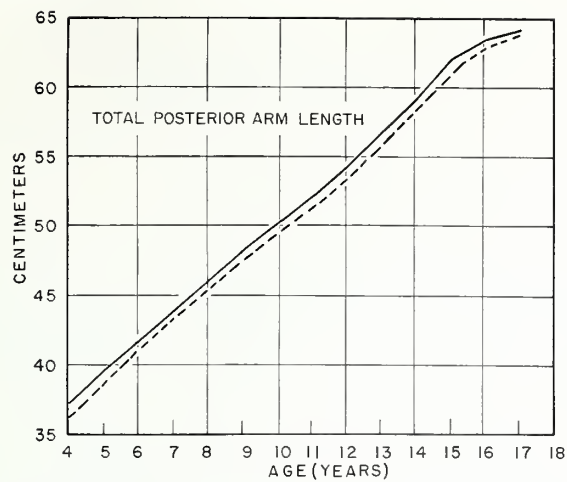
BOYS						
Age (years)	Socio-economic groups	General formula: $\log_e w = a + b(H - \bar{H})$	Residual variance	<i>t</i> values for <i>a</i> coefficients	<i>t</i> values for <i>b</i> coefficients	Number of cases
4	<i>A</i>	$\log_e w = 3.66935 + 0.01823(H - 106.1569)$	0.0067	0.50	6.97	306
	<i>B</i>	$\log_e w = 3.63109 + 0.01770(H - 104.3171)$	0.050			
5	<i>A</i>	$\log_e w = 3.77575 + 0.01958(H - 112.7255)$	0.057	.78	11.35	1,074
	<i>B</i>	$\log_e w = 3.73708 + 0.01879(H - 111.0698)$	0.067			
6	<i>A</i>	$\log_e w = 3.87519 + 0.01933(H - 118.6243)$	0.062	1.41	14.50	2,071
	<i>B</i>	$\log_e w = 3.83989 + 0.01886(H - 116.9627)$	0.059			
7	<i>A</i>	$\log_e w = 3.97260 + 0.01891(H - 123.9554)$	0.067	1.88	15.15	2,466
	<i>B</i>	$\log_e w = 3.93872 + 0.01816(H - 122.6258)$	0.058			
8	<i>A</i>	$\log_e w = 4.07530 + 0.01904(H - 129.5064)$	0.082	.89	16.51	2,741
	<i>B</i>	$\log_e w = 4.03697 + 0.01870(H - 127.9434)$	0.073			
9	<i>A</i>	$\log_e w = 4.17433 + 0.01849(H - 134.7116)$	0.087	1.51	17.87	3,003
	<i>B</i>	$\log_e w = 4.13343 + 0.01793(H - 132.9797)$	0.073			
10	<i>A</i>	$\log_e w = 4.26753 + 0.01900(H - 139.4663)$	0.103	1.05	21.08	3,230
	<i>B</i>	$\log_e w = 4.21717 + 0.01861(H - 137.5896)$	0.083			
11	<i>A</i>	$\log_e w = 4.35095 + 0.01860(H - 143.7072)$	0.110	1.34	17.87	3,234
	<i>B</i>	$\log_e w = 4.30604 + 0.01810(H - 142.3027)$	0.090			
12	<i>A</i>	$\log_e w = 4.45129 + 0.01859(H - 149.0739)$	0.116	1.19	19.63	3,466
	<i>B</i>	$\log_e w = 4.39765 + 0.01816(H - 147.1601)$	0.103			
13	<i>A</i>	$\log_e w = 4.56196 + 0.01756(H - 155.0609)$	0.117	1.29	19.31	3,430
	<i>B</i>	$\log_e w = 4.50911 + 0.01798(H - 152.9590)$	0.104			
14	<i>A</i>	$\log_e w = 4.67912 + 0.01725(H - 161.2800)$	0.114	1.04	17.86	2,664
	<i>B</i>	$\log_e w = 4.62464 + 0.01761(H - 159.0406)$	0.097			

GIRLS						
Age (years)	Socio-economic groups	General formula: $\log_e w = a + b(H - \bar{H})$	Residual variance	<i>t</i> values for <i>a</i> coefficients	<i>t</i> values for <i>b</i> coefficients	Number of cases
4	<i>A</i>	$\log_e w = 3.63859 + 0.01967(H - 105.5180)$	0.0078	1.09	6.93	388
	<i>B</i>	$\log_e w = 3.60045 + 0.01847(H - 103.6440)$	0.066			
5	<i>A</i>	$\log_e w = 3.75005 + 0.02052(H - 111.8909)$	0.075	1.76	15.11	1,219
	<i>B</i>	$\log_e w = 3.69991 + 0.01944(H - 109.9349)$	0.066			
6	<i>A</i>	$\log_e w = 3.84365 + 0.02013(H - 117.4369)$	0.084	.15	11.65	2,234
	<i>B</i>	$\log_e w = 3.81284 + 0.02005(H - 116.1796)$	0.073			
7	<i>A</i>	$\log_e w = 3.95181 + 0.02093(H - 122.9813)$	0.090	2.93	14.97	2,464
	<i>B</i>	$\log_e w = 3.91341 + 0.01959(H - 121.5292)$	0.084			
8	<i>A</i>	$\log_e w = 4.05469 + 0.02061(H - 128.4928)$	0.105	3.27	15.95	2,713
	<i>B</i>	$\log_e w = 4.01289 + 0.01918(H - 127.0274)$	0.090			
9	<i>A</i>	$\log_e w = 4.15080 + 0.02016(H - 133.3642)$	0.123	.83	14.93	2,976
	<i>B</i>	$\log_e w = 4.11007 + 0.01980(H - 131.9731)$	0.105			
10	<i>A</i>	$\log_e w = 4.25730 + 0.01997(H - 138.8972)$	0.145	1.00	14.04	2,967
	<i>B</i>	$\log_e w = 4.21621 + 0.01953(H - 137.5684)$	0.119			
11	<i>A</i>	$\log_e w = 4.37196 + 0.01929(H - 144.9607)$	0.166	.88	13.96	2,976
	<i>B</i>	$\log_e w = 4.32845 + 0.01891(H - 143.2997)$	0.127			

The correlations between seven measurements for each of the age-socioeconomic group classifications are given in tables 61 and 62. For the sake of economy, the correlations of these seven measurements for socioeconomic group *A* were placed above the main diagonal of the matrix. Those for socioeconomic group *B* were placed below the main diagonal. These correlations may be useful in further studies.





BOYS  
 — SOCIOECONOMIC GROUP A  
 - - - SOCIOECONOMIC GROUP B

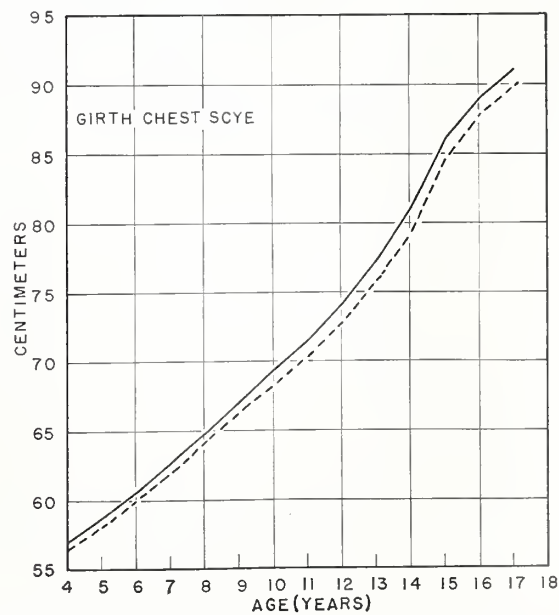
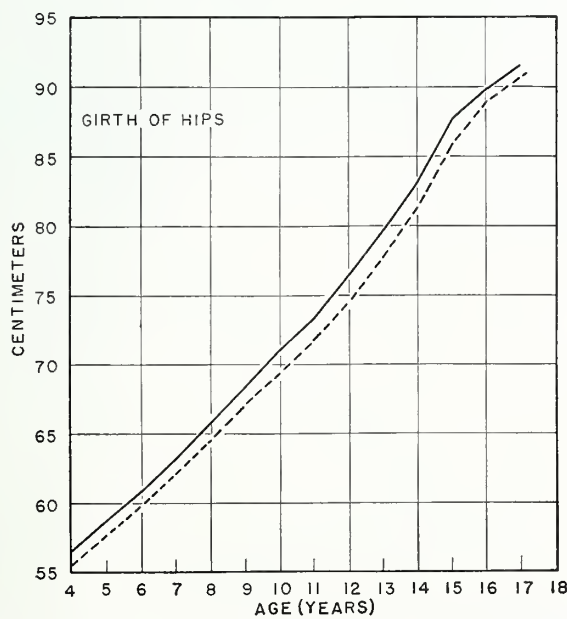
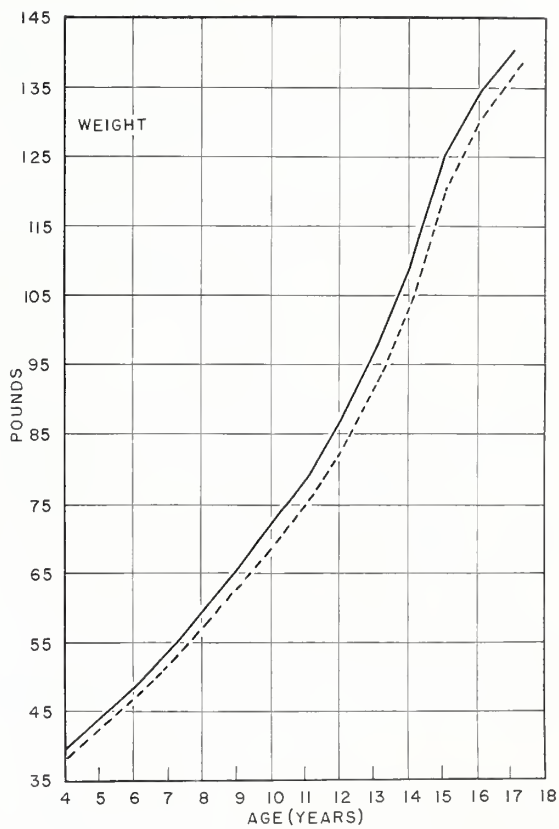
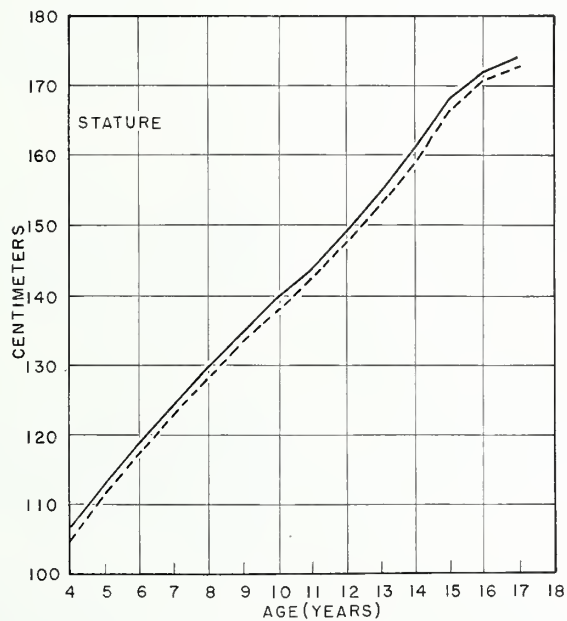
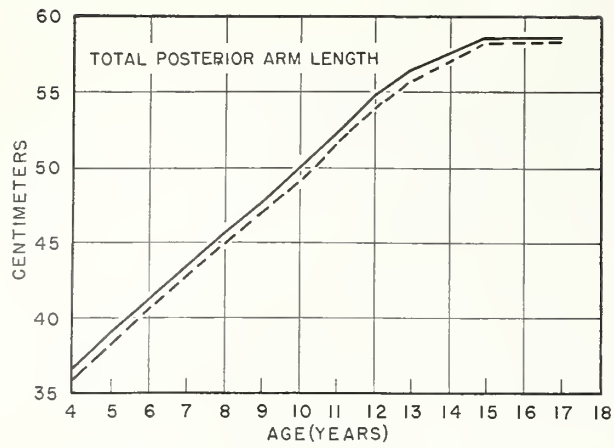


FIGURE 57.—Means of each of five measurements of boys for each age group 4 to 17, inclusive, and each of the two socio-economic groups A and B.



GIRLS  
 ——— SOCIOECONOMIC GROUP A  
 - - - SOCIOECONOMIC GROUP B

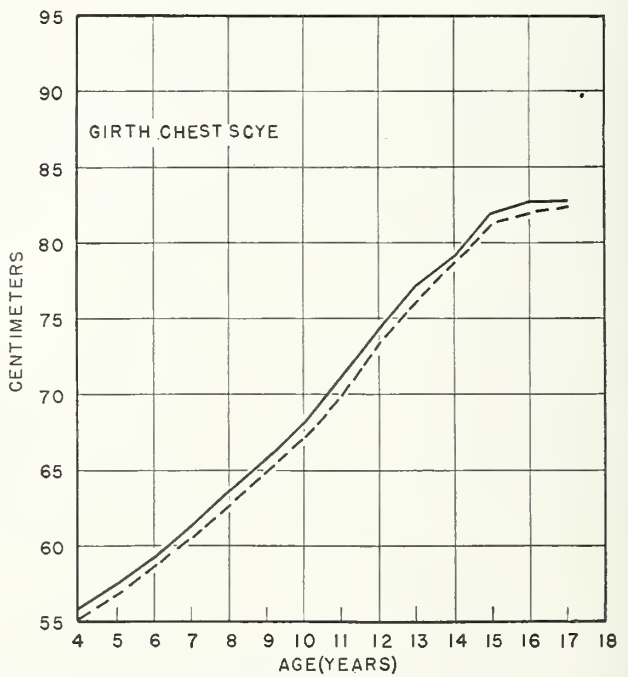
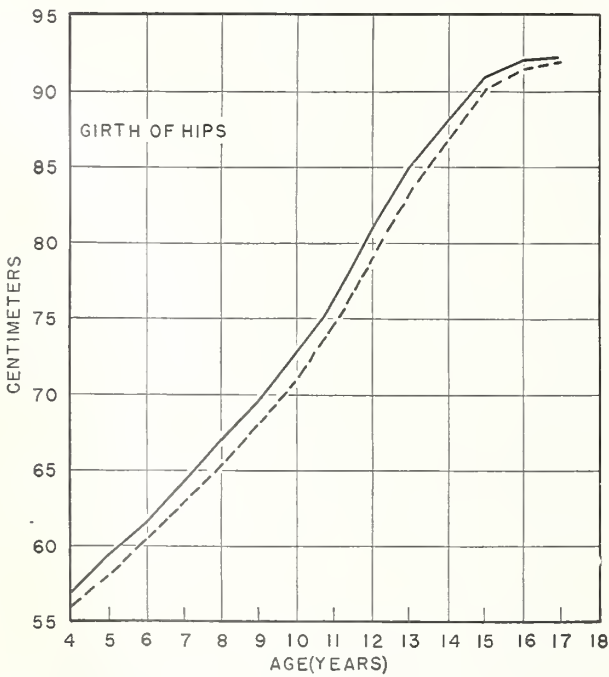
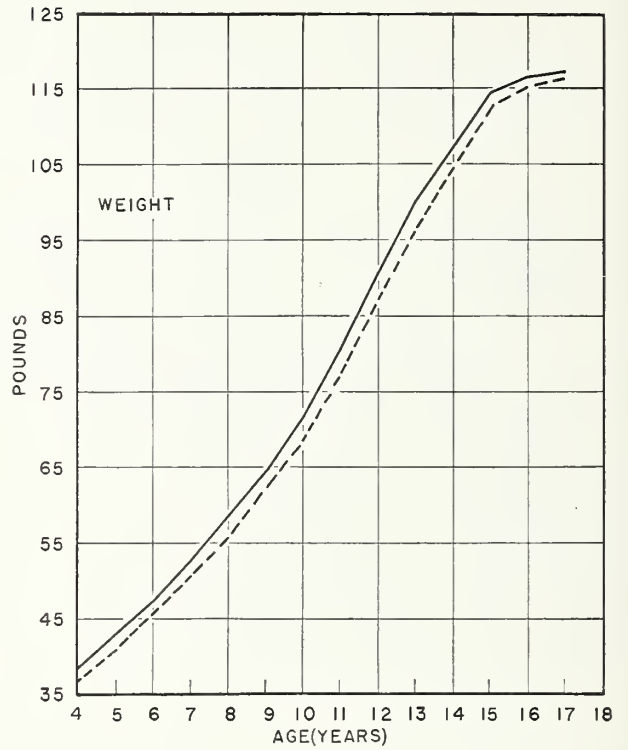
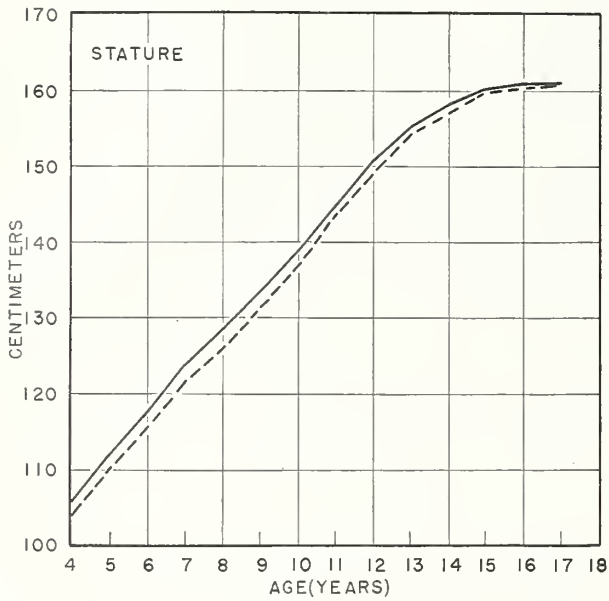


FIGURE 58.—Means of each of five measurements of girls for each age group 4 to 17, inclusive, and each of the two socioeconomic groups A and B.

TABLE 61.—Intercorrelations<sup>1</sup> of 7 measurements for socioeconomic groups A and B for boys aged 4 to 17

Measurement	Age 4 (306 boys of group A and 492 boys of group B)							Age 5 (1,074 boys of group A and 1,060 boys of group B)							Age 6 (2,071 boys of group A and 2,011 boys of group B)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height	0.692	0.687	0.903	0.491	0.585	0.846	0.662	0.716	0.712	0.893	0.551	0.609	0.832	0.634	0.714	0.715	0.911	0.528	0.605	0.840	0.645
Weight	<sup>2</sup> 0.907	.802	.757	.777	.900	.695	.801	<sup>2</sup> 0.917	.793	.798	.799	.896	.714	.806	<sup>2</sup> 0.906	.794	.789	.798	.915	.697	.834
Stature	.525	.771	.604	.559	.643	.837	.752	.565	.794	.629	.608	.677	.832	.767	.591	.759	.591	.591	.680	.830	.766
Chest girth at armscye	.529	.840	.640	.722	.758	.544	.667	.612	.892	.688	.746	.745	.600	.650	.560	.801	.603	.603	.768	.566	.714
Hip girth	.872	.704	.856	.585	.582	.626	.758	.857	.799	.847	.601	.619	.618	.749	.620	.908	.690	.768	.606	.606	.785
Total posterior arm length	.592	.763	.712	.630	.652	.599	.688	.674	.822	.784	.683	.759	.641	.630	.841	.711	.830	.608	.630	.606	.629
Vertical trunk girth															.650	.818	.782	.676	.765	.644	
	Age 7 (2,466 boys of group A and 2,544 boys of group B)							Age 8 (2,741 boys of group A and 3,019 boys of group B)							Age 9 (3,003 boys of group A and 3,096 boys of group B)						
Hip height	0.713	0.692	0.907	0.540	0.575	0.834	0.633	0.698	0.703	0.925	0.567	0.594	0.859	0.658	0.695	0.692	0.922	0.559	0.590	0.854	0.662
Weight	<sup>2</sup> 0.914	.792	.767	.830	.917	.702	.831	<sup>2</sup> 0.917	.774	.772	.857	.930	.705	.859	<sup>2</sup> 0.919	.767	.756	.859	.939	.705	.853
Stature	.560	.818	.617	.589	.649	.832	.774	.563	.834	.611	.620	.669	.854	.784	.602	.850	.609	.598	.654	.852	.786
Chest girth at armscye	.604	.909	.682	.776	.786	.587	.704	.611	.926	.681	.800	.829	.602	.752	.562	.850	.609	.609	.825	.604	.734
Hip girth	.853	.712	.844	.609	.622	.602	.776	.859	.719	.851	.616	.636	.619	.818	.862	.703	.854	.598	.627	.626	.805
Total posterior arm length	.628	.817	.762	.693	.762	.626	.668	.656	.830	.781	.710	.786	.661	.654	.651	.846	.780	.724	.799	.650	.669
Vertical trunk girth																					
	Age 10 (3,230 boys of group A and 3,258 boys of group B)							Age 11 (3,234 boys of group A and 3,112 boys of group B)							Age 12 (3,466 boys of group A and 2,992 boys of group B)						
Hip height	0.691	0.674	0.923	0.557	0.585	0.851	0.659	0.686	0.667	0.925	0.559	0.564	0.872	0.665	0.688	0.707	0.931	0.589	0.620	0.868	0.708
Weight	<sup>2</sup> 0.915	.771	.745	.883	.948	.701	.872	<sup>2</sup> 0.925	.764	.745	.891	.948	.706	.877	<sup>2</sup> 0.927	.775	.772	.900	.954	.731	.887
Stature	.550	.860	.616	.607	.659	.847	.782	.548	.872	.601	.612	.644	.870	.793	.527	.890	.640	.638	.684	.866	.824
Chest girth at armscye	.593	.941	.674	.826	.849	.617	.771	.599	.945	.678	.839	.859	.617	.781	.598	.950	.686	.686	.868	.637	.792
Hip girth	.865	.713	.859	.612	.634	.673	.673	.863	.696	.850	.598	.625	.623	.832	.867	.727	.865	.637	.654	.591	.842
Total posterior arm length	.656	.857	.788	.743	.817	.668	.673	.660	.873	.794	.752	.827	.658	.698	.669	.881	.806	.772	.840	.695	.727
Vertical trunk girth																					
	Age 13 (3,430 boys of group A and 2,684 boys of group B)							Age 14 (2,664 boys of group A and 1,997 boys of group B)							Age 15 (2,810 boys of group A and 1,727 boys of group B)						
Hip height	0.706	0.691	0.920	0.575	0.599	0.882	0.692	0.699	0.659	0.907	0.547	0.566	0.862	0.663	0.616	0.551	0.869	0.434	0.462	0.827	0.543
Weight	<sup>2</sup> 0.926	.803	.794	.896	.950	.746	.897	<sup>2</sup> 0.916	.824	.795	.897	.950	.746	.900	<sup>2</sup> 0.888	.769	.717	.892	.946	.668	.860
Stature	.606	.903	.688	.667	.702	.891	.846	.587	.907	.709	.863	.650	.816	.527	.887	.624	.892	.644	.849	.788	.773
Chest girth at armscye	.628	.953	.724	.868	.870	.650	.809	.621	.956	.753	.868	.857	.665	.857	.524	.951	.689	.847	.857	.599	.825
Hip girth	.882	.753	.883	.679	.683	.742	.742	.879	.756	.886	.673	.691	.745	.742	.851	.719	.878	.608	.646	.599	.652
Total posterior arm length	.701	.898	.843	.818	.860	.738	.738	.694	.896	.865	.819	.856	.745	.742	.737	.781	.942	.832	.873	.817	.652
Vertical trunk girth																					
	Age 16 (2,532 boys of group A and 1,372 boys of group B)							Age 17 (1,802 boys of group A and 899 boys of group B)													
Hip height	0.489	0.460	0.803	0.310	0.347	0.807	0.449	0.429	0.365	0.862	0.201	0.232	0.804	0.360	0.489	0.460	0.803	0.310	0.347	0.807	0.449
Weight	<sup>2</sup> 0.867	.641	.645	.870	.938	.611	.822	<sup>2</sup> 0.864	.586	.514	.839	.912	.478	.774	<sup>2</sup> 0.867	.641	.645	.870	.938	.611	.822
Stature	.323	.860	.466	.417	.472	.775	.661	.323	.860	.466	.417	.472	.775	.661	.323	.860	.466	.417	.472	.775	.661
Chest girth at armscye	.375	.939	.544	.814	.820	.493	.705	.375	.939	.544	.814	.820	.493	.705	.375	.939	.544	.814	.820	.493	.705
Hip girth	.817	.610	.829	.482	.508	.519	.767	.817	.610	.829	.482	.508	.519	.767	.817	.610	.829	.482	.508	.519	.767
Total posterior arm length	.472	.816	.722	.703	.781	.587	.583	.472	.816	.722	.703	.781	.587	.583	.472	.816	.722	.703	.781	.587	.583
Vertical trunk girth																					

<sup>1</sup> For each age group the intercorrelations for the measurements of the boys of group A are in the upper right-hand corner of the section and the intercorrelations for the measurements of the boys of group B are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

TABLE 62.—Intercorrelations<sup>1</sup> of 7 measurements for socioeconomic groups A and B for girls aged 4 to 17

Measurement	Age 4 (388 girls of group A and 587 girls of group B)							Age 5 (1,219 girls of group A and 1,337 girls of group B)							Age 6 (2,234 girls of group A and 2,266 girls of group B)						
	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth	Hip height	Weight	Stature	Chest girth	Hip girth	Total arm length	Vertical trunk girth
Hip height		0.627	0.907	0.475	0.507	0.805	0.555		0.694	0.905	0.524	0.584	0.828	0.632		0.673	0.904	0.520	0.571	0.821	0.625
Weight	0.708		.720	.812	.860	.666	.791	0.707		.775	.813	.900	.693	.811	0.713		.748	.839	.925	.675	.818
Stature	<sup>2</sup> .898	.772		.549	.582	.812	.695	<sup>2</sup> .912	.790		.589	.658	.820	.763	<sup>2</sup> .915	.784		.578	.639	.815	.760
Chest girth at armseye	.514	.786	.557		.753	.559	.665	.520	.808	.578		.792	.357	.685	.555	.828	.606		.808	.561	.695
Hip girth	.567	.904	.632	.756		.689	.729	.608	.909	.679	.761		.607	.746	.609	.916	.668	.777		.586	.769
Total posterior arm length	.833	.711	.843	.545	.613		.575	.853	.702	.842	.555	.610		.607	.850	.708	.840	.573	.610		.612
Vertical trunk girth	.625	.776	.740	.621	.711	.627		.626	.805	.754	.656	.741	.604		.650	.831	.779	.692	.765	.640	
	Age 7 (2,464 girls of group A and 2,838 girls of group B)							Age 8 (2,713 girls of group A and 2,956 girls of group B)							Age 9 (2,976 girls of group A and 3,124 girls of group B)						
Hip height		0.689	0.908	0.551	0.597	0.846	0.651		0.692	0.919	0.559	0.606	0.862	0.681		0.677	0.912	0.549	0.583	0.857	0.642
Weight	0.688		.761	.853	.932	.697	.846	0.670		.759	.878	.941	.709	.872	0.677		.732	.893	.950	.692	.875
Stature	<sup>2</sup> .912	.756		.599	.661	.847	.778	<sup>2</sup> .914	.744		.601	.664	.856	.800	<sup>2</sup> .913	.748		.588	.641	.851	.771
Chest girth at armseye	.531	.838	.578		.825	.586	.728	.545	.855	.595		.841	.599	.662	.553	.881	.602		.856	.593	.778
Hip girth	.593	.926	.652	.799		.614	.797	.575	.935	.642	.818		.631	.695	.592	.943	.659	.852		.614	.832
Total posterior arm length	.852	.705	.853	.576	.615		.659	.851	.681	.844	.583	.597		.688	.864	.692	.859	.591	.619		.655
Vertical trunk girth	.646	.816	.778	.687	.761	.657		.629	.832	.765	.719	.780	.620		.660	.865	.787	.757	.815	.663	
	Age 10 (2,967 girls of group A and 3,179 girls of group B)							Age 11 (2,976 girls of group A and 3,040 girls of group B)							Age 12 (3,062 girls of group A and 2,714 girls of group B)						
Hip height		0.644	0.911	0.539	0.572	0.855	0.657		0.651	0.911	0.556	0.586	0.869	0.672		0.587	0.889	0.470	0.524	0.846	0.613
Weight	0.684		.717	.906	.959	.685	.886	0.662		.728	.908	.958	.696	.885	0.636		.709	.898	.960	.668	.886
Stature	<sup>2</sup> .916	.744		.590	.641	.859	.792	<sup>2</sup> .914	.749		.615	.664	.869	.811	<sup>2</sup> .902	.739		.576	.656	.854	.803
Chest girth at armseye	.571	.896	.613		.879	.594	.795	.556	.903	.605		.881	.616	.803	.534	.910	.618		.869	.568	.780
Hip girth	.602	.943	.658	.856		.619	.850	.591	.955	.679	.871		.639	.856	.570	.962	.686	.884		.617	.860
Total posterior arm length	.869	.710	.869	.614	.631		.686	.859	.703	.866	.615	.643		.701	.844	.700	.852	.611	.649		.683
Vertical trunk girth	.668	.869	.801	.775	.820	.689		.655	.878	.804	.784	.843	.691		.653	.895	.815	.797	.875	.698	
	Age 13 (2,696 girls of group A and 2,361 girls of group B)							Age 14 (1,936 girls of group A and 1,653 girls of group B)							Age 15 (2,428 girls of group A and 1,414 girls of group B)						
Hip height		0.477	0.852	0.351	0.386	0.807	0.501		0.414	0.834	0.261	0.301	0.734	0.385		0.414	0.849	0.210	0.263	0.756	0.387
Weight	0.513		.632	.886	.953	.582	.859	0.397		.560	.856	.929	.492	.811	0.355		.514	.809	.917	.474	.766
Stature	<sup>2</sup> .865	.681		.480	.567	.812	.743	<sup>2</sup> .841	.570		.371	.467	.742	.647	<sup>2</sup> .841	.477		.292	.379	.761	.612
Chest girth at armseye	.413	.885	.548		.845	.471	.727	.278	.855	.401		.800	.356	.668	.159	.801	.261		.754	.338	.594
Hip girth	.430	.948	.618	.844		.522	.833	.276	.935	.479	.804		.400	.773	.165	.898	.316	.739		.372	.719
Total posterior arm length	.822	.629	.836	.537	.570		.585	.634	.485	.574	.231	.281		.465	.785	.425	.782	.270	.276		.436
Vertical trunk girth	.525	.876	.761	.763	.847	.620		.386	.832	.662	.680	.803	.294		.344	.749	.593	.568	.700	.398	
	Age 16 (2,135 girls of group A and 1,106 girls of group B)							Age 17 (1,404 girls of group A and 639 girls of group B)													
Hip height		0.413	0.854	0.192	0.235	0.767	0.390		0.434	0.864	0.180	0.276	0.792	0.417							
Weight	0.403		.504	.787	.893	.446	.727	0.448		.509	.790	.949	.477	.750							
Stature	<sup>2</sup> .851	.485		.261	.346	.774	.609	<sup>2</sup> .874	.519		.254	.374	.795	.624							
Chest girth at armseye	.203	.811	.267		.704	.294	.551	.204	.806	.251		.719	.273	.585							
Hip girth	.246	.903	.347	.730		.313	.658	.255	.910	.358	.739		.365	.695							
Total posterior arm length	.787	.454	.778	.304	.336		.418	.772	.478	.790	.290	.344		.456							
Vertical trunk girth	.414	.761	.613	.567	.694	.439		.456	.748	.624	.549	.691	.440								

<sup>1</sup> For each age group the intercorrelations for the measurements of the girls of group A are in the upper right-hand corner of the section and the intercorrelations for the measurements of the girls of group B are in the lower left-hand corner.

<sup>2</sup> Overlapping measurements (see footnote 12, p. 30).

It was shown by analyses of the combined data from 16 States that in general the sets of means of the two socioeconomic groups differ significantly. The question might be raised: Do significant socioeconomic differences exist within States? Such an analysis was contemplated. However, time permitted only the

calculations of the means and standard deviations for each of seven measurements, for each State, age, sex, and socioeconomic group classification. These are given in tables 63 through 66. A cursory study of these tables will show that, on the whole, significant socioeconomic differences do exist within the States analyzed.

TABLE 63.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group A, boys aged 6 to 14

HIP HEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	114	57.32	3.27	186	61.27	3.28	184	64.28	3.73	210	67.25	3.56	222	71.18	3.93	220	73.57	4.02	248	76.97	4.30	216	80.62	5.40	203	83.89	5.39
California	115	58.37	3.30	114	62.25	3.17	126	65.63	3.76	134	69.53	3.79	139	73.14	4.57	153	75.46	4.48	131	79.11	4.85	129	82.53	5.18	129	86.02	4.50
Colorado	85	58.04	3.03	81	61.37	3.49	91	65.02	3.83	112	68.42	3.90	110	71.17	4.15	112	74.64	4.18	108	78.69	4.91	101	81.93	3.97	81	84.04	4.56
District of Columbia, Maryland, and Virginia	293	58.14	3.45	318	61.45	3.95	341	65.33	4.20	391	68.24	4.77	393	71.17	4.47	369	74.53	4.51	686	78.68	4.91	861	81.62	4.85	713	84.56	4.75
Illinois	121	58.60	3.66	167	62.38	3.71	195	64.59	4.11	197	68.00	3.95	237	71.12	4.24	268	73.82	4.67	252	77.25	5.04	247	80.69	5.19	193	83.59	4.99
Iowa	207	57.24	3.36	205	60.36	3.29	244	64.29	3.42	230	67.99	3.84	271	70.86	4.48	225	73.93	4.12	127	76.52	4.88	86	79.63	4.89	73	84.40	4.60
Kansas	85	58.02	3.65	118	61.43	3.48	128	64.97	3.98	121	68.38	3.84	123	71.98	4.21	139	75.12	4.83	200	77.91	4.33	222	80.89	4.70	148	83.96	4.85
Michigan	91	58.10	3.33	133	61.25	3.12	165	64.60	4.11	165	67.92	3.78	234	71.20	3.97	207	73.75	4.17	210	76.48	4.52	132	80.12	4.54	98	83.84	4.92
Minnesota	283	57.61	3.39	245	60.44	3.25	252	64.82	4.20	285	68.46	4.03	267	71.65	4.03	281	74.30	4.25	258	77.72	5.09	301	81.46	5.27	217	84.74	4.98
Nebraska	134	57.68	3.63	158	61.18	3.71	147	64.74	3.77	166	67.64	4.23	157	71.13	4.14	140	73.39	4.81	103	76.03	4.42	84	80.26	2.78	35	82.23	3.99
Ohio	97	57.77	3.43	123	60.45	3.24	167	64.63	4.03	220	68.23	4.18	252	70.87	4.13	240	73.88	4.11	236	77.08	4.67	248	81.13	4.86	171	83.81	5.07
Pennsylvania	150	58.00	3.34	170	60.77	3.91	203	63.67	4.26	199	67.89	4.26	226	70.13	4.18	249	73.64	4.64	332	76.94	4.88	358	80.11	5.31	330	83.23	5.12
Tennessee	57	57.11	3.18	90	61.10	3.55	149	64.55	3.99	166	67.06	4.08	161	70.21	3.75	183	72.39	4.23	168	76.35	4.66	194	79.79	4.95	116	84.18	4.71
Texas	172	58.29	3.15	248	61.83	3.37	216	65.36	3.79	236	68.63	3.40	234	72.32	3.57	200	74.62	3.90	244	78.36	4.20	166	81.22	4.40	112	84.44	4.54
Utah	64	59.00	3.91	110	62.05	3.16	133	65.28	3.80	171	69.25	4.25	207	71.93	4.19	188	73.91	4.34	163	76.67	4.59	85	80.85	4.58	45	82.96	5.74

WEIGHT

Alabama	114	47.04	5.34	186	52.47	7.11	184	57.89	8.82	210	61.87	8.55	222	70.42	10.50	220	75.58	13.28	248	83.16	15.36	216	90.86	16.26	203	105.51	21.00
California	115	50.94	6.30	114	56.78	6.48	126	62.98	9.91	134	70.64	9.31	139	79.88	14.57	153	85.31	14.95	131	95.24	16.90	129	104.60	20.14	129	118.00	18.45
Colorado	85	48.27	5.20	81	52.70	6.23	91	57.62	7.69	112	65.17	9.47	110	70.70	9.96	112	78.26	11.54	108	87.77	16.84	101	96.75	16.73	81	105.14	19.22
District of Columbia, Maryland, and Virginia	293	48.84	6.39	318	53.92	7.71	341	60.66	8.92	391	66.35	10.73	393	71.88	12.56	369	79.12	13.20	686	89.88	16.85	861	99.24	18.15	713	111.53	19.92
Illinois	121	49.90	7.73	167	55.63	7.71	195	59.94	10.01	197	66.51	9.93	237	72.74	12.27	268	79.06	14.08	252	86.77	16.86	247	98.18	18.66	193	109.15	20.18
Iowa	207	48.17	6.48	205	52.35	6.81	244	59.70	9.45	230	66.08	10.57	271	72.93	11.85	225	81.05	14.60	127	86.46	16.55	86	97.81	16.82	73	111.85	22.07
Kansas	85	48.34	5.81	118	53.71	7.73	128	59.92	8.93	121	66.07	10.18	123	72.31	11.83	139	79.97	13.09	200	89.62	16.42	222	97.52	16.35	148	108.53	18.71
Michigan	91	49.63	7.53	133	54.13	6.12	165	59.98	9.21	165	66.07	8.87	234	72.02	11.29	207	79.28	13.92	210	84.42	14.19	132	95.67	18.15	98	109.73	19.39
Minnesota	283	48.00	6.25	245	52.60	6.59	252	59.66	9.16	285	67.21	10.34	267	72.68	12.12	281	79.06	13.05	258	88.08	16.48	301	98.46	17.45	217	111.49	19.32
Nebraska	134	48.19	6.48	158	53.59	7.50	147	59.35	9.13	166	63.86	10.26	157	72.33	10.98	140	76.30	12.87	103	81.76	13.13	84	95.61	18.83	35	101.94	14.95
Ohio	97	49.24	8.04	123	52.28	6.40	167	59.29	8.88	220	65.87	10.63	252	71.63	11.53	240	78.24	12.72	236	84.53	14.48	248	97.77	18.07	171	107.28	19.84
Pennsylvania	150	48.39	6.38	170	52.52	6.57	203	57.68	7.53	199	63.96	10.23	226	71.33	12.59	249	79.50	13.95	332	87.26	15.95	358	97.23	19.33	330	108.69	21.65
Tennessee	57	46.23	4.39	90	53.93	8.66	149	58.61	9.59	166	63.08	9.55	161	68.57	10.38	183	73.16	11.39	168	83.02	13.86	194	93.28	17.96	116	107.26	19.40
Texas	172	48.77	7.20	248	54.68	8.36	216	60.00	8.17	236	66.23	9.67	234	74.22	12.14	260	79.82	13.46	244	89.66	16.03	166	97.96	18.53	112	106.51	17.30
Utah	64	49.56	6.21	110	53.02	6.75	133	58.25	8.39	171	65.30	9.13	207	71.06	11.88	188	74.90	11.63	163	81.76	13.09	85	90.94	15.16	45	101.89	17.87

STATURE

Alabama	114	117.55	5.18	186	123.73	5.23	184	128.88	5.82	210	133.00	5.52	222	138.99	5.72	220	142.90	6.38	248	147.95	7.09	216	153.92	9.05	203	160.75	9.51
California	115	120.23	5.53	114	126.26	5.06	126	131.06	5.66	134	137.27	5.96	139	142.74	7.29	153	146.28	6.55	131	152.12	7.51	129	158.13	8.88	129	164.60	7.75
Colorado	85	119.13	4.95	81	124.49	5.61	91	129.66	5.83	112	135.31	5.70	110	139.75	5.76	112	144.78	6.18	108	151.04	7.59	101	156.04	6.86	81	160.83	8.08
District of Columbia, Maryland, and Virginia	293	118.74	5.46	318	123.98	5.85	341	130.10	6.44	391	134.61	6.97	393	138.92	6.95	369	144.05	6.93	686	150.18	7.67	861	155.79	8.37	713	161.92	8.28
Illinois	121	119.73	5.64	167	125.84	5.77	195	129.16	6.19	197	134.45	6.24	237	139.39	6.91	268	143.51	7.46	252	149.17	8.00	247	154.99	7.79	193	160.48	8.46
Iowa	207	117.78	5.38	205	122.75	5.22	244	128.98	5.43	230	134.77	5.91	271	139.38	6.86	225	143.95	6.30	127	148.25	8.01	86	153.81	8.42	73	162.42	8.82
Kansas	85	119.16	5.30	118	124.34	5.26	128	130.01	5.44	121	134.86	6.18	123	140.23	6.15	139	145.71	7.53	200	150.26	7.42	222	155.60	7.65	148	161.13	8.62
Michigan	91	118.68	5.46	133	123.56	4.79	165	129.13	6.27	165	133.98	5.61	234	139.13	6.22	207	143.20	6.54	210	147.36	6.98	132	153.44	8.25	98	160.88	8.67
Minnesota	283	118.13	5.42	245	122.51	5.02	252	129.58	6.63	285	135.37	6.10	267	139.64	6.22	281	143.84	6.76	258	149.28	8.11	301	155.69	8.46	217	162.02	8.08
Nebraska	134	119.07	5.59	158	124.55	5.84	147	130.20	5.92	166	134.66	6.69	157	139.94	6.37	140	143.09	7.38	103	147.30	6.96	84	155.00	8.04	35	159.66	7.78
Ohio	97	118.70	5.66	123	123.40	5.14	167	129.80	6.28	220	134.81	6.44	252	139.16	6.42	240	143.68	6.53	236	148.42	7.07	248	155.56	7.77	171	160.81	8.79
Pennsylvania	150	118.07	5.24	170	123.08	5.70	203	127.71	6.11	199	134.34	6.42	226	137.84	6.40	249	142.87	6.82	332	148.21	7.56	358	153.75	9.25	330	160.08	9.37
Tennessee	57	117.30	4.43	90	123.94	5.71	149	129.46	6.22	166	133.68	6.36	161	138.35	5.84	183	141.97	6.33	168	147.81	7.03	194	153.20	8.33	116	161.40	8.34
Texas	172	118.61	5.12	248	124.31	5.26	216	129.73	5.81	236	134.69	5.23	234	140.46	5.61	260	144.08	6.04	244	149.76	6.75	166	154.94	7.59	112	160.21	8.11
Utah	64	119.97	6.26	110	124.46	5.04	133	129.89	6.0																		

TABLE 63.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group A, boys aged 6 to 14—Continued

**HIP GIRTH**

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	114	60.19	3.09	186	62.49	4.27	184	64.97	4.65	210	66.73	4.41	222	70.32	4.88	220	72.25	5.60	248	75.14	6.24	216	77.47	5.85	203	82.11	7.18
California	115	62.03	3.54	114	64.26	3.36	126	67.57	4.94	134	70.52	4.47	139	73.97	6.21	153	76.10	6.38	131	79.11	6.64	129	81.46	6.73	129	85.76	5.92
Colorado	85	60.67	3.34	81	63.01	3.10	91	64.86	3.82	112	68.38	4.71	110	70.38	4.60	112	73.46	5.07	108	76.28	6.12	101	79.14	6.04	81	81.67	6.34
District of Columbia, Maryland, and Virginia	293	61.11	3.66	318	63.38	4.15	341	66.37	4.67	391	68.72	5.27	393	71.02	5.51	369	73.77	5.57	686	77.55	6.48	861	80.31	6.46	713	84.07	6.76
Illinois	121	61.47	4.66	167	64.21	4.31	195	65.90	5.16	197	68.46	4.98	237	71.10	5.69	268	73.60	5.91	252	76.10	6.41	247	79.87	6.34	193	83.20	6.65
Iowa	207	60.82	3.62	205	62.75	3.78	244	66.09	4.55	230	68.63	5.07	271	71.53	5.22	225	74.72	5.92	127	76.61	6.59	85	80.00	6.19	73	84.66	7.47
Kansas	85	60.80	3.50	118	63.25	4.37	128	66.13	4.44	121	68.90	5.00	123	71.41	5.17	139	74.08	5.51	200	77.87	6.51	222	80.37	5.63	148	83.13	6.02
Michigan	91	60.76	4.14	133	62.98	3.47	165	66.98	4.55	165	67.62	4.39	234	70.54	5.20	207	73.82	6.10	210	75.16	5.26	132	78.81	6.49	98	82.81	6.12
Minnesota	283	60.33	3.74	245	62.28	3.85	252	65.43	4.51	285	68.93	5.20	267	70.92	5.78	281	73.19	5.42	258	76.31	6.26	301	79.56	6.03	217	83.38	6.19
Nebraska	134	60.85	3.79	158	63.06	4.13	147	65.80	4.59	166	67.87	5.01	157	71.39	5.01	140	72.63	5.62	103	74.70	5.65	84	78.74	6.10	35	81.29	6.49
Ohio	97	61.06	4.70	123	62.04	4.13	167	65.14	4.47	220	68.16	4.95	252	70.37	5.21	240	73.11	5.70	236	75.16	5.89	248	79.46	6.48	171	82.59	6.49
Pennsylvania	150	60.22	4.10	170	62.56	3.88	203	64.86	3.70	199	68.31	4.93	226	70.38	5.98	249	73.45	6.04	332	76.83	6.36	358	80.21	7.03	330	83.53	7.18
Tennessee	57	59.09	2.75	90	63.04	5.02	149	65.02	4.87	166	67.07	4.83	161	69.69	4.97	183	71.08	4.97	168	75.17	5.55	194	78.07	6.67	116	82.34	6.30
Texas	172	61.52	4.29	248	64.23	4.79	216	66.43	4.14	236	69.14	4.85	234	72.50	5.57	260	74.34	5.82	244	78.11	6.43	166	80.30	6.35	112	83.04	5.88
Utah	64	61.19	3.22	110	62.67	3.51	133	64.89	4.27	171	67.82	4.51	207	70.26	5.44	188	71.78	4.89	163	73.89	5.19	85	77.29	5.46	45	80.38	6.00

**TOTAL POSTERIOR ARM LENGTH**

Alabama	114	41.17	2.38	186	43.73	2.24	184	46.07	2.48	210	47.53	2.48	222	50.23	2.69	220	51.80	2.90	248	53.97	3.17	216	56.46	3.59	203	59.26	4.08
California	115	42.24	2.29	114	44.78	2.10	126	46.67	2.62	134	49.13	2.59	139	51.47	3.11	153	53.20	2.92	131	55.46	3.23	129	57.84	3.89	129	60.55	3.18
Colorado	85	41.85	2.17	81	43.89	2.37	91	46.22	2.72	112	48.37	2.11	110	50.05	2.56	112	52.34	2.96	108	54.69	3.28	101	56.84	3.08	81	58.74	3.24
District of Columbia, Maryland, and Virginia	293	41.87	2.46	318	43.95	2.68	341	46.33	2.87	391	48.29	2.98	393	50.13	3.04	369	52.33	3.13	686	55.09	3.47	861	57.36	3.55	713	59.77	3.59
Illinois	121	42.01	2.46	167	44.48	2.60	195	45.90	2.73	197	48.07	2.98	237	50.32	2.93	268	51.99	3.34	252	54.46	3.54	247	56.70	3.50	193	58.85	3.66
Iowa	207	41.00	2.18	205	42.87	2.33	244	45.60	2.55	230	48.07	2.57	271	49.85	3.15	225	51.99	2.72	127	53.89	3.35	86	56.14	3.36	73	59.58	3.62
Kansas	85	41.99	2.58	118	44.07	2.33	128	46.30	2.55	121	48.59	2.75	123	50.51	2.90	139	52.83	3.06	200	55.12	3.27	222	56.88	3.38	148	59.24	3.65
Michigan	91	41.81	2.26	133	43.83	2.14	165	45.96	2.61	165	47.93	2.62	234	50.24	2.82	207	52.08	3.01	210	53.83	3.13	132	56.48	3.42	98	59.22	3.47
Minnesota	283	41.59	2.30	245	43.48	2.27	252	46.13	2.80	285	48.71	3.06	267	50.41	2.95	281	52.16	3.07	258	54.59	3.44	301	56.83	3.55	217	59.24	3.59
Nebraska	134	41.84	2.54	158	44.07	2.44	147	46.35	2.41	166	48.22	2.84	157	50.48	2.88	140	51.86	3.33	103	53.53	3.21	84	56.81	3.65	35	58.71	3.71
Ohio	97	41.74	2.41	123	43.43	2.23	167	46.19	2.76	220	48.28	2.81	252	49.97	2.78	240	51.76	2.87	236	54.03	3.10	248	56.85	3.35	171	59.14	3.64
Pennsylvania	150	41.51	2.55	170	43.74	2.54	203	45.49	2.72	199	48.30	2.94	226	49.77	3.17	249	52.08	3.27	332	54.12	3.39	358	56.28	3.74	330	58.83	3.87
Tennessee	57	41.12	2.10	90	43.72	2.57	149	46.05	2.68	166	47.63	2.92	161	49.57	2.89	183	51.20	3.04	168	53.90	3.11	194	56.28	3.64	116	59.47	3.56
Texas	172	41.72	2.29	248	44.03	2.34	216	46.10	2.51	236	48.27	2.42	234	50.44	2.71	260	51.94	2.75	244	54.56	3.06	166	56.54	3.44	112	58.40	3.09
Utah	64	42.08	2.56	110	44.25	2.22	133	46.29	2.66	171	48.74	2.95	207	50.38	3.05	188	51.78	3.01	163	53.69	3.09	85	56.45	3.18	45	58.81	3.70

**VERTICAL TRUNK GIRTH**

Alabama	114	104.37	3.96	186	108.20	4.96	184	111.84	5.35	210	114.51	5.04	222	119.38	5.30	220	122.52	6.55	248	126.67	7.33	216	131.71	9.05	203	139.30	10.10
California	115	106.60	4.53	114	109.96	4.35	126	114.15	5.54	134	118.75	5.42	139	122.83	6.99	153	125.98	6.94	131	131.52	7.21	129	138.12	9.53	129	145.12	8.33
Colorado	85	105.91	4.94	81	109.02	5.25	91	111.91	5.13	112	117.17	5.54	110	119.99	5.56	112	124.02	6.66	108	130.02	7.86	101	134.48	7.88	81	140.46	9.27
District of Columbia, Maryland, and Virginia	293	105.74	4.80	318	109.15	5.06	341	113.72	5.64	391	117.30	5.96	393	120.35	6.41	369	124.56	6.89	686	129.76	8.05	861	135.22	9.16	713	141.57	9.18
Illinois	121	105.90	5.08	167	109.90	4.67	195	112.67	5.72	197	115.90	5.49	237	119.37	6.62	268	123.25	7.05	252	127.48	7.78	247	133.96	9.12	193	139.64	9.30
Iowa	207	104.80	4.78	205	107.89	4.78	244	112.50	5.34	230	116.41	5.78	271	120.03	6.27	225	124.13	6.80	127	127.31	8.08	86	133.17	8.62	73	141.63	10.86
Kansas	85	104.91	4.29	118	108.65	4.89	128	112.09	5.30	121	115.92	5.88	123	119.66	6.34	139	124.06	7.17	200	128.91	7.83	222	134.05	7.92	148	139.76	9.21
Michigan	91	104.92	5.40	133	108.11	4.47	165	112.28	5.60	165	114.75	5.20	234	118.96	6.34	207	122.53	6.83	210	125.92	6.81	132	131.59	9.40	98	139.76	10.06
Minnesota	283	104.46	5.05	245	107.64	4.47	252	112.52	5.82	285	117.18	5.97	267	120.01	6.35	281	123.16	6.73	258	127.65	7.64	301	133.51	8.77	217	141.20	9.57
Nebraska	134	103.99	4.88	158	108.39	5.33	147	112.03	5.63	166	114.86	6.05	157	119.24	5.81	140	121.96	7.38	103	125.11	7.03	84	133.38	9.41	35	137.91	8.82
Ohio	97	105.55	5.57	123	108.18	4.51	167	112.53	5.61	220	116.46	5.99	252	119.98	5.97	240	123.73	6.63	236	127.39	6.98	248	134.32	8.78	171	139.83	9.06
Pennsylvania	150	105.55	4.95	170	108.93	5.19	203	112.45	5.00	199	117.64	5.90	226	120.29	6.44	249	124.67	7.02	332	129.36	8.04	358	134.79	9.89	330	141.06	10.45
Tennessee	57	102.49	4.36	90	107.61	5.64	149	110.54	6.24	166	114.01	5.67	161	117.32	5.55	183	119.99	6.12	168	125.52	7.11	194	131.54	9.09	116	139.49	9.23
Texas	172	104.20	4.93	248	108.23	5.37	216	112.06	5.19	236	115.51	5.42	234	120.15	6.21	260	123.14	6.58	244	128.55	7.12	166	133.17	8.97	112	138.02	9.12
Utah	64	105.66	4.52	110	108.25	4.60	133	111.97	5.71	171	116.51	5.73	207	119.63	6.90	188	121.82	6.66	163	126.05	6.85	85	131.34	7.87	45	136.29	9.34

TABLE 64.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group B, boys aged 6 to 14

HIP HEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	169	57.13	2.85	250	60.23	3.25	298	63.38	3.55	285	66.53	3.65	326	69.56	3.84	290	72.73	4.26	285	75.69	4.54	241	79.04	4.35	206	82.47	4.68
California	118	57.17	3.43	115	60.71	3.67	133	64.90	4.11	158	67.88	3.73	132	70.60	4.11	125	75.27	4.11	145	77.52	4.73	151	81.68	4.74	139	85.01	5.01
Colorado	178	56.71	3.35	217	59.58	3.58	271	63.66	3.80	254	66.86	3.97	287	70.34	4.27	260	72.92	4.10	306	76.58	4.31	227	80.07	4.84	212	82.98	5.14
District of Columbia, Maryland, and Virginia	119	57.54	3.73	168	60.79	3.78	174	63.93	4.06	208	67.16	4.12	194	70.60	4.73	197	72.63	4.70	213	76.32	5.14	228	79.61	5.06	156	82.71	5.01
Illinois	35	58.54	3.08	95	61.69	3.79	134	65.04	4.16	135	67.30	4.30	145	70.60	4.41	131	73.59	4.43	150	76.51	4.61	150	79.33	5.05	83	83.14	5.26
Iowa	210	56.12	3.00	224	59.94	3.05	300	63.48	3.50	253	66.67	3.65	281	69.38	4.27	276	73.00	4.59	191	75.65	4.33	143	78.96	4.56	95	82.62	4.50
Kansas	132	56.45	2.95	199	60.05	3.78	212	64.29	3.84	207	66.58	3.71	232	70.16	4.34	208	73.29	4.03	310	76.95	4.67	281	79.96	4.92	229	83.42	4.83
Michigan	59	56.97	2.94	83	61.04	3.36	137	64.09	3.75	135	67.45	3.94	155	70.49	3.94	137	73.36	4.18	133	75.57	4.31	93	79.10	4.86	84	82.21	5.43
Minnesota	278	56.76	3.46	312	60.85	3.56	321	64.03	3.74	400	67.53	4.47	349	70.27	4.31	347	73.54	4.35	283	76.36	4.94	298	79.97	5.48	256	83.34	5.27
Nebraska	69	56.72	3.88	63	60.02	3.35	78	63.19	3.59	66	68.05	3.50	90	70.07	4.19	62	71.44	4.32	59	74.61	4.46	50	77.94	4.91	17	81.00	4.46
Ohio	197	56.52	3.47	269	60.17	3.76	321	62.91	3.82	356	66.47	4.15	329	69.78	4.16	366	72.27	4.61	322	75.84	4.57	268	78.99	4.71	185	81.38	4.67
Pennsylvania	100	56.42	3.29	119	59.68	3.72	95	63.20	4.05	117	66.16	4.21	119	68.65	4.28	86	73.02	4.40	80	75.39	4.90	101	78.84	5.07	98	82.21	4.78
Tennessee	95	56.01	4.17	119	59.57	4.04	180	62.99	3.91	153	66.16	4.79	209	69.42	3.99	202	72.04	4.40	143	75.33	4.20	134	78.41	5.12	75	81.64	4.62
Texas	157	58.24	2.82	184	60.87	3.56	197	64.09	3.55	192	67.80	3.73	198	70.82	3.68	217	74.39	4.18	199	77.37	4.27	198	80.56	4.27	100	83.23	4.94
Utah	89	57.67	3.37	127	62.02	3.53	168	64.91	3.42	177	67.89	3.87	227	70.74	3.97	208	73.75	4.60	173	76.30	3.93	121	79.35	4.88	62	82.21	4.76

WEIGHT

Alabama	169	46.85	5.25	250	50.66	5.33	298	54.94	6.17	285	60.77	7.23	326	66.13	9.24	290	71.71	10.31	285	77.81	13.20	241	87.12	14.58	206	98.05	17.64
California	118	49.36	5.57	115	53.81	6.32	133	61.08	8.84	158	67.87	9.96	132	73.39	12.06	125	82.92	13.76	145	89.76	14.29	151	103.77	17.71	139	115.78	20.60
Colorado	178	45.20	5.22	217	49.18	6.73	271	56.00	7.92	254	61.87	8.14	287	67.41	10.46	260	73.28	10.90	306	81.07	13.49	227	91.39	15.06	212	100.79	16.74
District of Columbia, Maryland, and Virginia	119	48.04	7.48	168	52.75	7.32	174	57.10	8.98	208	63.15	8.62	194	69.56	10.05	197	73.58	10.94	213	83.17	16.19	228	93.34	20.21	156	103.82	19.28
Illinois	35	51.54	6.56	95	54.02	8.13	134	60.22	9.37	135	64.05	8.86	145	70.34	11.23	131	73.59	14.64	150	85.05	15.09	150	93.05	16.43	83	103.67	18.60
Iowa	210	46.19	5.67	224	51.71	6.37	300	57.67	8.59	253	63.23	8.32	281	68.34	10.88	276	76.32	12.65	191	82.10	14.57	143	94.07	18.77	95	103.44	19.41
Kansas	132	46.76	5.56	199	51.06	6.77	212	58.47	8.73	207	62.65	9.15	232	69.34	10.52	208	74.49	11.49	310	85.91	15.09	281	94.25	16.33	229	106.52	19.12
Michigan	59	47.49	5.67	83	53.37	6.79	137	59.05	8.81	135	64.61	9.42	155	69.90	11.38	137	77.06	12.08	133	81.17	11.65	93	92.01	17.26	84	107.86	18.75
Minnesota	278	46.83	6.50	312	52.34	6.87	321	57.10	7.69	400	63.95	9.68	349	69.36	10.78	347	76.73	13.09	283	84.12	14.56	298	94.68	19.37	256	106.94	19.97
Nebraska	69	46.67	5.91	63	51.79	6.05	78	55.68	7.20	66	65.00	9.45	90	68.96	10.23	62	72.50	9.29	59	78.44	11.99	50	88.72	14.09	17	103.71	19.07
Ohio	197	46.32	6.50	269	52.09	7.25	321	55.78	7.90	356	62.18	9.04	329	68.14	10.25	366	73.71	11.56	322	82.18	14.18	268	90.14	15.69	185	98.17	16.94
Pennsylvania	100	46.31	5.35	119	51.92	7.00	95	59.59	10.13	117	62.58	12.00	119	67.21	11.49	86	74.97	12.17	80	80.25	12.94	101	92.28	16.64	98	106.97	18.94
Tennessee	95	45.35	6.75	119	49.94	5.68	180	55.46	8.30	153	60.33	8.35	200	66.13	10.56	202	72.01	10.77	143	78.43	14.23	134	86.60	14.75	75	97.28	15.64
Texas	157	48.44	6.62	184	52.34	7.01	197	56.84	7.55	192	63.98	10.51	198	69.97	10.96	217	77.45	12.12	199	82.70	12.02	198	91.64	15.82	100	101.45	18.05
Utah	89	46.83	5.44	127	52.09	5.93	168	56.85	7.26	177	62.88	7.27	227	68.28	10.97	208	74.58	11.46	173	80.78	11.96	121	89.05	14.92	62	97.68	16.51

STATURE

Alabama	169	117.02	4.70	250	122.16	5.01	298	126.99	5.59	285	131.99	5.70	326	136.69	6.04	290	141.40	6.62	285	146.26	7.04	241	151.45	7.09	206	158.09	8.08
California	118	118.14	5.78	115	123.59	5.82	133	130.28	6.19	158	134.66	5.57	132	138.82	6.43	125	145.84	5.87	145	149.36	7.27	151	156.86	7.64	139	163.05	8.34
Colorado	178	116.64	5.38	217	121.35	6.01	271	127.78	6.03	254	132.92	5.87	287	137.94	6.49	260	142.34	6.28	306	147.52	6.93	227	153.82	7.77	212	159.23	8.67
District of Columbia, Maryland, and Virginia	119	117.45	5.79	168	122.89	6.13	174	127.54	6.56	208	132.48	6.43	194	137.41	6.59	197	140.87	6.67	213	146.81	7.82	228	152.33	8.49	156	158.83	8.52
Illinois	35	120.00	4.99	95	124.44	6.05	134	130.02	6.43	135	133.30	6.80	145	138.52	6.68	131	143.39	6.90	150	147.52	6.80	150	153.02	8.44	83	158.73	8.78
Iowa	210	115.82	5.13	224	122.20	4.88	300	127.85	5.62	253	132.64	5.78	281	136.67	6.73	276	142.40	6.96	191	146.45	7.40	143	152.70	7.99	95	158.66	8.25
Kansas	132	116.49	5.25	199	122.19	5.95	212	128.96	6.18	207	132.77	5.76	232	138.05	6.69	208	142.72	6.39	310	148.71	7.51	281	154.20	8.36	229	160.29	8.56
Michigan	59	116.76	5.09	83	123.25	5.01	137	128.01	5.86	135	133.65	6.17	155	137.72	6.25	137	142.72	6.45	133	145.93	6.69	93	152.35	8.35	84	159.49	9.56
Minnesota	278	116.65	5.56	312	123.04	5.61	321	128.12	5.63	400	133.49	6.74	349	137.63	6.42	347	142.91	6.52	283	147.58	7.76	298	153.39	8.00	256	159.71	9.13
Nebraska	69	117.48	6.40	63	122.60	5.49	78	127.04	5.58	66	135.00	5.92	90	138.20	6.21	62	140.53	6.15	59	145.00	7.09	50	151.16	8.24	17	158.18	8.64
Ohio	197	116.93	5.29	269	122.71	5.80	321	127.06	5.98	356	132.54	6.43	329	137.47	6.26	366	141.46	6.82	322	146.77	7.19	268	152.13	8.02	185	156.56	8.19
Pennsylvania	100	116.34	5.21	119	121.69	6.02	95	127.67	6.11	117	131.76	6.31	119	135.65	6.37	86	141.99	6.85	80	145.65	7.46	101	152.34	8.17	98	159.19	8.72
Tennessee	95	115.78	6.50	119	123.05	5.75	180	126.83	5.97	153	132.12	5.69	200	136.97	6.55	202	141.00	6.77	143	146.01	6.96	134	150.92	8.30	75	157.13	7.68
Texas	157	118.46	4.69	184	123.05	5.37	197	127.69	5.41	192	133.51	5.66	198	138.19	5.66	217	143.36	6.40	199	147.86	6.51	198	153.49	7.25	100	158.26	9.01
Utah	89	117.73	5.42	127	124.03	5.49	168	129.04	5.49	177	133.68	5.84	227	138.17	6.32	208	142.54	6.87	173	146.86	6.15	121	151.93</				

TABLE 64.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group B, boys aged 6 to 14—Continued

HIP GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	169	60.04	3.16	250	61.54	2.92	298	63.50	3.27	285	66.18	3.66	326	68.34	4.42	290	70.62	4.67	285	72.75	5.15	241	76.13	5.69	206	79.58	5.96
California	118	61.19	3.06	115	63.17	3.44	133	66.69	4.46	158	69.14	4.18	132	71.52	5.37	125	75.06	5.75	145	77.43	5.69	151	81.38	6.11	139	84.78	6.62
Colorado	178	59.12	3.01	217	60.86	3.56	271	64.11	4.07	254	66.60	4.37	287	68.75	4.46	260	71.29	4.98	306	73.98	5.37	227	77.26	5.41	212	80.16	5.58
District of Columbia, Maryland, and Virginia	119	60.41	3.83	168	62.55	4.00	174	64.36	4.58	208	67.22	4.05	194	69.76	4.78	197	71.17	4.70	213	75.06	6.32	228	78.34	6.80	156	81.47	6.35
Illinois	35	62.51	3.49	95	63.11	4.07	134	65.73	4.72	135	67.43	4.54	145	69.79	5.27	131	73.05	6.41	150	75.43	5.85	150	78.26	6.00	83	81.55	6.26
Iowa	210	59.78	3.37	224	62.41	3.60	300	64.98	4.32	253	67.31	4.25	281	69.41	5.01	276	72.68	5.31	191	74.74	5.74	143	78.64	6.55	95	81.85	6.44
Kansas	132	59.84	3.22	199	61.79	3.79	212	65.22	4.15	207	66.94	4.30	232	70.03	4.94	208	71.90	4.86	310	76.05	5.91	281	78.93	5.80	229	82.72	6.20
Michigan	59	59.76	3.38	83	62.30	3.79	137	65.36	4.80	135	67.63	4.69	155	69.61	4.98	137	72.58	5.40	133	73.77	4.84	93	77.37	6.12	84	82.90	6.03
Minnesota	278	59.68	3.66	312	62.32	3.74	321	64.76	4.01	400	67.24	4.63	349	69.58	4.71	347	72.19	5.59	283	75.00	5.47	298	78.44	6.93	256	82.19	6.43
Nebraska	69	59.26	3.23	63	62.21	3.53	78	63.81	3.71	66	68.02	4.47	90	69.64	4.67	62	70.77	3.92	59	73.20	5.11	50	77.02	5.54	17	81.47	6.93
Ohio	197	59.10	3.43	269	61.76	3.71	321	63.88	3.92	356	66.28	4.39	329	68.62	4.58	366	70.94	5.06	322	73.92	5.54	268	76.70	5.70	185	79.17	5.82
Pennsylvania	100	59.26	3.17	119	62.55	4.01	95	66.32	5.04	117	67.44	5.66	119	69.32	5.40	86	71.94	5.32	80	74.25	5.18	101	78.35	5.95	98	83.00	6.34
Tennessee	95	58.48	3.76	119	60.83	3.21	180	63.37	4.44	153	65.90	4.11	200	68.06	4.90	202	70.36	4.52	143	72.78	5.27	134	75.56	5.40	75	78.71	5.62
Texas	157	60.93	3.80	184	62.82	3.84	197	64.73	3.96	192	67.78	5.13	198	70.23	5.02	217	73.38	5.27	199	75.29	4.80	198	77.93	5.87	100	81.25	5.93
Utah	89	59.67	3.11	127	62.13	3.30	168	64.07	3.64	177	66.84	3.58	227	69.15	5.01	208	71.40	4.91	173	73.88	4.78	121	76.40	5.40	62	79.13	5.61

TOTAL POSTERIOR ARM LENGTH

Alabama	169	41.21	2.04	250	43.25	2.22	298	45.19	2.43	285	47.21	2.51	326	49.16	2.71	290	51.30	2.82	285	53.09	3.05	241	55.54	3.08	206	58.18	3.54
California	118	41.46	2.49	115	43.57	2.53	133	46.24	2.67	158	48.18	2.54	132	49.95	2.89	125	52.86	2.93	145	54.17	3.24	151	57.15	3.50	139	59.85	3.57
Colorado	178	40.96	2.48	217	42.65	2.56	271	45.35	2.57	254	47.44	2.86	287	49.71	2.87	260	51.39	2.85	306	53.73	3.09	227	55.97	3.41	212	58.05	3.74
District of Columbia, Maryland, and Virginia	119	41.50	2.61	168	43.49	2.60	174	45.46	2.84	208	47.43	2.81	194	49.56	2.94	197	50.93	3.15	213	53.31	3.42	228	55.84	3.67	156	58.19	3.93
Illinois	35	41.94	1.92	95	43.96	2.76	134	46.14	2.71	135	47.93	2.88	145	49.86	2.86	131	51.96	3.05	150	53.87	3.25	150	55.93	3.41	83	58.37	3.48
Iowa	210	40.36	2.16	224	42.94	2.31	300	45.15	2.49	253	47.06	2.44	281	48.89	3.15	276	51.27	2.97	191	52.94	3.17	143	55.35	3.61	95	57.79	3.18
Kansas	132	41.19	2.44	199	43.16	2.57	212	45.91	2.60	207	47.44	2.65	232	49.77	2.88	208	51.63	2.66	310	54.24	3.20	281	56.28	3.54	229	58.87	3.62
Michigan	59	41.00	2.21	83	43.77	2.48	137	45.77	2.67	135	47.84	2.83	155	49.67	2.95	137	51.78	3.01	133	53.41	2.98	93	55.86	3.56	84	58.87	3.82
Minnesota	278	41.13	2.34	312	43.58	2.45	321	45.60	2.46	400	47.79	2.89	349	49.60	2.97	347	51.80	3.06	283	53.61	3.57	298	56.00	3.87	256	58.56	3.56
Nebraska	69	41.13	2.44	63	43.33	2.24	78	45.23	2.46	66	48.45	2.73	90	49.76	2.85	62	50.52	2.69	59	52.92	3.05	50	55.22	3.22	17	57.94	3.75
Ohio	197	40.91	2.31	269	43.15	2.41	321	44.95	2.63	356	47.05	2.70	329	49.28	2.91	366	50.86	2.98	322	53.08	3.07	268	55.23	3.23	185	57.03	3.41
Pennsylvania	100	40.90	2.38	119	42.98	2.65	95	45.62	2.81	117	47.38	3.03	119	48.75	3.07	86	51.27	3.45	80	52.90	3.09	101	55.62	3.46	98	58.61	3.40
Tennessee	95	40.67	2.89	119	43.03	2.51	188	44.83	2.89	153	47.08	2.65	200	49.00	2.89	202	50.90	2.89	143	53.00	2.97	134	55.31	3.54	75	57.56	3.28
Texas	157	41.67	2.13	184	43.32	2.53	197	45.04	2.36	192	47.50	2.46	198	49.51	2.62	217	51.77	2.94	199	53.71	3.05	198	55.89	2.96	100	57.87	3.98
Utah	89	41.13	2.34	127	43.90	2.46	168	45.77	2.43	177	47.73	2.36	227	49.66	2.69	208	51.79	3.22	173	53.23	2.76	121	55.53	3.50	62	57.87	3.72

VERTICAL TRUNK GIRTH

Alabama	169	104.02	3.88	250	107.14	4.19	298	110.33	4.39	285	113.90	4.66	326	117.44	5.74	290	120.98	6.08	285	124.70	6.99	241	130.17	7.86	206	136.20	8.97
California	118	105.31	4.44	115	108.81	5.23	133	113.41	5.45	158	117.09	4.87	132	120.42	5.97	125	125.72	6.39	145	129.88	7.54	151	137.92	8.78	139	144.09	9.41
Colorado	178	102.99	4.98	217	106.35	5.78	271	111.13	5.62	254	115.14	5.74	287	118.73	6.30	260	122.00	6.53	306	126.65	7.40	227	132.44	8.25	212	138.27	9.66
District of Columbia, Maryland, and Virginia	119	104.81	5.39	168	108.43	5.38	174	111.67	6.10	208	115.41	5.48	194	119.18	5.73	197	122.11	6.03	213	127.35	7.91	228	132.71	9.02	156	138.87	9.52
Illinois	35	106.49	4.24	95	108.19	4.99	134	112.43	5.23	135	114.78	5.76	145	118.41	6.33	131	123.08	7.42	150	126.73	7.14	150	132.17	9.27	83	137.65	9.52
Iowa	210	103.34	4.55	224	107.93	4.44	300	111.72	5.23	253	115.00	4.86	281	117.90	6.45	276	122.25	6.44	191	125.51	7.39	143	131.99	8.95	95	137.24	10.01
Kansas	132	103.70	4.82	199	107.18	4.87	212	112.11	5.50	207	114.89	5.59	232	118.88	6.19	208	121.66	6.26	310	127.31	7.76	281	132.46	8.53	229	139.08	9.25
Michigan	59	103.24	5.03	83	108.41	4.96	137	111.29	5.36	135	115.39	5.26	155	117.62	6.49	137	122.02	6.33	133	124.24	6.61	93	130.51	9.31	84	139.74	10.28
Minnesota	278	103.43	5.30	312	107.78	4.82	321	111.56	4.94	400	115.16	5.94	349	118.48	5.80	347	122.77	6.72	283	126.41	7.41	298	131.65	9.39	256	138.86	10.46
Nebraska	69	103.13	4.75	63	107.16	4.90	78	110.14	4.79	66	115.26	5.27	90	118.13	5.75	62	120.19	5.41	59	123.71	7.07	50	129.94	8.30	17	138.59	10.90
Ohio	197	104.20	4.43	269	108.16	5.05	321	110.94	5.45	356	115.17	5.65	329	118.51	5.76	366	121.86	6.51	322	125.92	7.56	268	130.73	7.99	185	135.85	9.08
Pennsylvania	100	105.23	4.64	119	109.06	4.95	95	113.80	5.81	117	116.58	6.97	119	119.56	6.44	86	123.98	6.11	80	126.73	7.02	101	133.14	8.57	98	139.99	9.32
Tennessee	95	101.68	4.65	119	105.13	4.18	180	109.03	5.20	153	112.75	5.20	200	116.24	6.15	202	119.77	6.37	143	123.63	7.46	134	128.70	8.33	75	134.64	9.16
Texas	157	104.22	4.57	184	107.30	4.52	197	110.20	4.86	192	114.59	5.82	198	117.90	5.86	217	122.12	6.39	199	125.39	6.20	198	130.88	7.59	100	136.24	9.55
Utah	89	103.84	4.76	127	107.94	4.73	168	111.38	4.93	177	114.76	4.89	227	118.38	6.34	208	121.40	6.28	173	125.27	6.62	121	130.06	7.62	62	134.68	8.63



TABLE 65.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group A, girls aged 6 to 14

HIP HEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama.....	167	57.76	3.26	193	60.62	3.42	228	64.48	3.80	241	67.45	3.63	267	70.96	4.03	252	74.73	4.33	293	78.10	4.42	266	80.30	4.26	230	81.80	4.34
California.....	115	58.56	3.43	119	62.28	3.67	128	66.02	3.57	137	69.47	3.94	136	72.85	4.11	135	76.74	4.47	126	79.33	4.26	92	80.93	4.37	70	82.01	4.50
Colorado.....	77	57.71	3.00	88	62.25	3.77	92	64.75	3.76	114	67.68	3.71	112	71.63	4.02	105	74.47	4.67	101	78.50	4.13	85	81.31	3.89	55	82.80	4.31
District of Columbia, Maryland, and Virginia.....	301	58.31	3.21	354	61.93	3.58	384	65.36	3.97	376	68.61	4.13	360	71.33	4.29	324	75.22	4.51	505	78.95	4.28	500	80.58	4.02	366	81.28	3.75
Illinois.....	142	58.72	3.06	160	61.97	3.41	183	64.60	4.21	216	67.38	4.48	225	71.05	4.88	260	74.33	4.70	227	76.96	4.12	207	79.01	4.47	114	80.81	4.09
Iowa.....	223	57.18	3.08	252	60.79	3.55	220	64.69	3.81	257	67.97	3.68	258	71.47	4.10	272	74.49	4.10	130	77.68	4.14	71	78.68	3.88	55	80.60	4.29
Kansas.....	108	57.23	3.25	143	61.13	3.38	147	64.86	3.57	148	68.33	4.41	164	71.46	4.07	206	75.41	4.20	252	78.17	4.50	265	80.29	3.88	222	80.76	4.13
Michigan.....	37	58.93	4.18	43	62.14	4.53	72	64.96	3.43	82	67.99	4.14	100	71.53	3.84	95	74.49	4.13	55	77.53	4.60	24	78.46	5.38	29	81.66	3.38
Minnesota.....	283	57.44	3.40	239	61.17	3.39	267	65.13	4.17	341	68.11	4.02	287	71.72	3.73	271	74.51	4.28	265	78.26	4.21	309	80.73	4.06	243	81.68	4.12
Nebraska.....	135	57.98	3.16	137	61.22	3.48	157	64.89	4.19	189	68.36	3.97	164	71.44	4.22	138	75.38	4.41	117	77.36	4.38	83	80.87	3.74	25	80.40	5.33
Ohio.....	71	57.99	3.58	60	61.73	2.97	79	65.71	4.19	108	68.24	3.93	99	71.53	4.36	94	74.98	4.12	92	78.64	4.07	73	80.52	4.18	45	82.22	3.95
Pennsylvania.....	177	57.69	3.48	212	61.20	3.62	206	64.21	3.95	220	67.25	4.12	228	71.03	4.01	239	74.28	4.74	326	77.18	4.58	325	79.54	4.22	238	80.21	4.34
Tennessee.....	91	57.99	3.44	135	60.73	3.69	124	63.84	4.03	155	66.55	4.00	153	70.54	4.54	139	73.34	4.09	141	77.30	4.59	117	80.00	3.67	75	79.73	3.86
Texas.....	190	58.17	3.44	225	61.80	3.45	274	65.21	3.88	232	68.56	4.36	234	72.40	3.81	285	76.07	4.12	306	78.92	3.78	227	81.21	3.62	156	82.51	3.79
Utah.....	117	59.03	3.77	104	62.32	4.19	152	65.29	3.93	160	68.21	3.81	180	71.61	4.07	161	74.81	4.55	126	77.63	4.11	52	79.04	4.25	13	80.38	5.61

WEIGHT

Alabama.....	167	46.23	6.03	193	51.24	8.58	228	56.00	8.52	241	61.15	10.20	267	68.19	12.51	252	76.64	13.90	293	87.42	18.17	266	97.78	18.70	230	103.84	15.62
California.....	115	50.17	7.45	119	56.43	9.37	128	63.71	11.14	137	70.96	12.22	136	79.86	14.46	135	89.39	15.52	126	96.64	17.24	92	108.50	20.74	70	114.87	15.34
Colorado.....	77	46.32	6.56	88	52.15	7.11	92	57.10	9.39	114	62.48	10.43	112	69.77	13.75	105	77.23	12.78	101	89.69	16.66	85	102.40	14.78	55	110.09	14.88
District of Columbia, Maryland, and Virginia.....	301	48.11	7.15	354	53.51	8.30	384	59.92	10.05	376	65.42	10.97	360	72.86	13.25	324	81.45	15.44	505	93.92	16.83	500	102.49	16.49	366	106.59	15.31
Illinois.....	142	49.96	9.76	160	53.71	9.22	183	59.69	10.61	216	65.56	13.92	225	71.80	13.88	260	81.64	16.84	227	90.94	16.47	207	100.99	17.72	114	109.35	15.62
Iowa.....	223	47.07	5.61	252	52.46	6.71	220	59.20	9.96	257	65.04	10.15	258	73.43	13.12	272	81.56	13.64	130	91.12	16.34	71	97.03	16.43	55	107.80	17.43
Kansas.....	108	46.06	6.46	143	53.11	9.02	147	58.63	8.59	148	64.30	10.61	164	70.91	12.39	206	81.94	15.04	252	91.40	17.14	265	101.62	16.85	222	108.40	16.27
Michigan.....	37	48.70	8.72	43	53.07	10.10	72	60.93	10.34	82	64.54	11.15	100	71.75	14.42	95	79.24	15.34	55	85.27	15.51	24	91.25	12.02	29	107.93	17.70
Minnesota.....	283	45.77	6.54	239	52.58	8.56	267	58.52	10.11	341	65.27	11.95	287	71.92	12.95	271	81.34	16.36	265	92.37	16.55	309	102.26	15.49	243	110.48	14.96
Nebraska.....	135	46.37	7.12	137	50.46	7.16	157	57.32	9.44	189	64.32	11.05	164	70.05	12.61	138	80.71	16.29	117	87.62	15.90	83	98.04	15.62	25	107.76	14.39
Ohio.....	71	46.24	7.11	60	51.80	6.47	79	57.61	9.97	108	64.82	11.77	99	70.69	14.60	94	77.07	13.02	92	88.20	14.47	73	100.67	18.17	45	110.20	22.03
Pennsylvania.....	177	46.65	6.98	212	52.67	8.44	206	57.77	10.58	220	63.71	12.16	228	73.08	15.00	239	82.44	18.77	326	92.06	18.31	325	102.52	18.36	238	107.02	15.32
Tennessee.....	91	47.11	6.04	135	51.23	8.35	124	56.02	10.05	155	60.85	9.49	153	70.87	13.98	139	75.86	13.82	141	89.79	15.18	117	97.62	13.29	75	102.97	14.90
Texas.....	190	47.30	7.13	225	52.49	8.08	274	58.12	9.93	232	64.63	11.31	234	72.74	12.47	285	81.14	14.87	306	90.94	15.94	227	99.55	17.23	156	106.61	15.66
Utah.....	117	46.79	5.79	104	52.08	9.00	152	56.07	8.94	160	62.33	9.75	180	68.33	10.13	161	77.17	14.19	126	85.90	15.33	52	91.50	15.88	13	97.54	12.09

STATURE

Alabama.....	167	117.16	4.98	193	121.84	5.13	228	127.68	5.66	241	132.13	6.38	267	137.98	6.37	252	144.29	7.18	293	150.85	7.48	266	155.89	7.00	230	159.26	6.17
California.....	115	119.37	5.11	119	124.91	6.04	128	130.92	5.81	137	136.33	6.58	136	141.75	6.79	135	148.33	7.01	126	153.11	7.19	92	156.65	6.93	70	160.34	6.87
Colorado.....	77	117.38	4.63	88	123.92	5.21	92	127.97	5.77	114	133.29	5.84	112	139.40	6.19	105	144.23	7.08	101	151.31	6.38	85	157.44	5.88	55	160.38	6.99
District of Columbia, Maryland, and Virginia.....	301	117.60	4.83	354	123.48	5.50	384	129.24	6.28	376	134.16	6.29	360	138.69	6.54	324	145.28	7.29	505	152.15	7.10	500	155.97	6.25	366	157.81	5.60
Illinois.....	142	118.92	7.08	160	123.94	6.52	183	128.17	6.69	216	132.18	6.70	225	137.92	7.36	260	144.30	7.44	227	149.50	6.97	207	154.26	7.32	114	158.78	6.98
Iowa.....	223	117.08	4.90	252	122.65	5.44	220	128.98	6.11	257	134.04	6.55	258	139.86	6.32	272	145.64	7.08	130	151.06	6.81	71	154.21	6.08	55	159.31	6.12
Kansas.....	108	116.90	5.44	143	123.03	5.47	147	128.57	5.69	148	133.63	6.55	164	138.89	6.48	206	145.86	7.06	252	151.49	7.60	265	156.59	6.41	222	158.85	5.92
Michigan.....	37	118.32	7.06	43	123.44	6.89	72	128.58	5.82	82	133.11	6.28	100	138.74	6.77	95	143.83	7.55	55	148.91	8.33	24	151.58	8.40	29	158.52	5.12
Minnesota.....	283	116.55	5.41	239	122.70	5.42	267	128.76	6.35	341	133.69	6.44	287	139.07	6.09	271	144.37	7.22	265	151.98	7.41	309	156.24	6.27	243	159.05	5.74
Nebraska.....	135	116.94	4.99	137	122.18	5.52	157	128.18	6.50	189	133.70	6.03	164	138.81	6.46	138	146.12	7.14	117	149.88	6.68	83	155.90	6.25	25	158.40	6.66
Ohio.....	71	116.66	5.58	60	122.77	4.26	79	128.19	6.33	108	132.78	6.37	99	137													

TABLE 65.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group A, girls aged 6 to 14—Continued

HIP GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	167	61.01	3.78	193	63.61	4.94	228	65.93	4.65	241	68.31	5.55	267	71.21	5.74	252	74.83	6.31	293	79.47	7.53	266	85.02	7.66	230	87.23	6.40
California	115	62.93	4.33	119	65.71	5.02	128	69.22	5.39	137	72.20	5.91	136	76.34	6.25	135	79.99	6.62	126	82.75	6.73	92	88.16	7.92	70	90.84	5.63
Colorado	77	60.90	4.16	88	63.86	4.01	92	65.92	5.34	114	68.47	5.24	112	71.49	6.41	105	74.88	5.64	101	80.02	7.17	85	85.59	5.89	55	89.04	5.85
District of Columbia, Maryland, and Virginia	301	61.91	4.40	354	64.81	4.61	384	67.45	5.08	376	70.04	5.37	360	73.23	6.30	324	76.80	6.69	505	82.09	7.12	500	85.77	6.69	366	88.04	6.09
Illinois	142	63.18	5.60	160	64.91	5.14	183	67.78	5.65	216	70.12	6.76	225	72.72	6.38	260	77.17	7.40	227	80.98	7.06	207	84.91	7.28	114	89.14	6.03
Iowa	223	61.45	3.59	252	64.02	3.86	220	67.11	5.25	257	69.71	5.03	258	73.44	6.11	272	76.62	6.11	130	80.80	6.78	71	83.93	7.02	55	88.56	6.27
Kansas	108	60.64	4.10	143	64.54	5.18	147	66.78	4.75	148	69.37	5.38	164	72.53	5.69	206	76.96	6.51	252	81.28	7.23	265	85.57	6.97	222	88.74	6.51
Michigan	37	61.49	5.01	43	63.58	5.33	72	68.03	5.39	82	70.00	5.53	100	72.48	6.57	95	75.74	6.64	55	77.91	6.51	24	80.46	5.27	29	87.52	6.92
Minnesota	283	60.34	3.98	239	63.85	4.97	267	66.49	5.31	341	69.82	5.76	287	72.54	6.02	271	76.62	7.00	265	80.94	6.79	309	85.42	6.10	243	88.77	5.98
Nebraska	135	61.23	4.25	137	62.99	4.04	157	66.38	4.83	189	69.48	5.56	164	71.97	6.02	138	76.38	7.14	117	79.54	6.58	83	83.45	6.20	25	88.68	5.91
Ohio	71	60.72	4.51	60	62.98	3.86	79	65.86	5.33	108	69.02	5.56	99	71.62	6.43	94	74.24	6.25	92	79.03	6.19	73	84.71	7.67	45	87.82	7.44
Pennsylvania	177	60.75	4.07	212	63.94	4.91	206	66.34	5.61	220	69.07	5.86	228	73.03	6.66	239	76.84	8.11	326	81.05	7.58	325	85.58	7.59	288	87.45	5.87
Tennessee	91	61.16	4.00	135	63.27	4.70	124	65.41	5.40	155	67.54	4.95	153	72.29	6.62	139	74.34	6.22	141	80.24	6.90	117	84.07	6.03	75	86.88	5.44
Texas	190	61.86	4.11	225	64.43	4.57	274	67.01	5.39	232	70.09	5.60	234	73.56	5.96	285	77.12	6.44	306	81.13	6.85	227	85.06	7.04	156	88.13	6.00
Utah	117	60.79	3.28	104	63.08	4.61	152	65.36	4.73	160	67.93	4.93	180	70.81	4.91	161	74.77	6.28	126	78.33	6.71	52	80.87	6.33	13	84.31	5.34

TOTAL POSTERIOR ARM LENGTH

Alabama	167	40.82	2.15	193	42.75	2.18	228	45.03	2.56	241	47.06	2.53	267	49.30	2.94	252	52.05	3.13	293	54.61	3.28	266	56.62	3.05	230	57.80	2.64
California	115	41.44	2.51	119	43.77	2.61	128	46.40	2.59	137	48.66	2.83	136	50.96	3.07	135	53.59	3.10	126	55.16	3.02	92	56.97	3.00	70	57.46	3.09
Colorado	77	40.90	2.02	88	43.80	2.31	92	45.59	2.76	114	47.39	2.57	112	49.73	2.79	105	51.77	3.01	101	55.13	3.10	85	57.31	2.64	55	57.91	5.91
District of Columbia, Maryland, and Virginia	301	40.68	2.33	354	43.04	2.41	384	45.38	2.87	376	47.55	2.83	360	49.50	3.05	324	52.24	3.38	505	55.39	3.20	500	56.77	2.93	366	57.52	2.53
Illinois	142	41.61	3.14	160	43.63	2.92	183	45.62	2.85	216	47.29	3.00	225	49.68	3.24	250	52.45	3.34	227	54.31	3.07	207	56.05	3.36	114	57.61	2.77
Iowa	223	40.46	2.12	252	42.83	2.27	220	45.50	2.54	257	47.47	2.51	258	49.97	2.73	272	52.02	2.90	130	54.79	3.16	71	56.15	2.87	55	57.33	2.65
Kansas	108	40.95	2.31	143	43.34	2.51	147	45.63	2.49	148	47.88	2.74	164	50.12	3.04	206	52.75	3.17	252	55.10	3.15	265	57.09	2.84	222	57.55	2.79
Michigan	37	41.92	2.81	43	43.70	3.00	72	45.71	2.49	82	47.80	2.99	100	50.16	3.20	95	52.61	3.39	55	54.65	3.97	24	55.54	3.35	29	58.14	2.86
Minnesota	283	40.80	2.29	239	43.45	2.40	267	45.84	2.71	341	47.93	2.81	287	50.12	2.93	271	52.27	3.09	265	55.25	3.13	309	57.14	2.75	243	58.09	2.56
Nebraska	135	40.96	2.00	137	43.15	2.29	157	45.55	2.53	189	47.62	2.54	164	49.95	2.83	138	52.71	3.10	117	54.50	2.70	83	56.64	2.70	25	57.76	3.23
Ohio	71	40.79	2.18	60	42.87	1.94	79	45.58	3.24	108	47.17	2.87	99	49.45	3.06	94	51.69	3.11	92	54.35	2.94	73	56.07	3.33	45	57.78	2.48
Pennsylvania	177	40.84	2.36	212	43.10	2.37	206	45.08	2.58	220	47.30	2.89	228	49.77	2.97	239	52.32	3.41	326	54.51	3.30	325	56.30	3.05	288	57.27	2.79
Tennessee	91	41.21	2.07	135	42.91	2.49	124	44.95	3.04	155	46.89	2.67	153	49.66	3.25	139	51.37	2.97	141	54.53	3.06	117	56.69	2.86	75	57.17	2.63
Texas	190	41.16	2.60	225	43.02	2.22	274	45.39	2.55	232	47.41	2.90	234	49.87	2.49	285	52.62	3.08	306	54.85	2.99	227	56.53	2.75	156	57.98	2.63
Utah	117	41.54	2.32	104	43.90	2.72	152	45.85	2.66	160	47.84	2.88	180	49.96	2.61	161	52.39	3.12	126	54.40	3.15	52	55.48	3.20	13	57.23	3.96

VERTICAL TRUNK GIRTH

Alabama	167	102.40	4.34	193	105.29	4.99	228	108.94	5.18	241	112.07	5.53	267	117.10	6.45	252	121.96	7.26	293	128.08	7.97	266	133.73	7.82	230	137.63	6.92
California	115	103.82	4.75	119	108.36	5.72	128	113.02	6.02	137	117.12	6.39	136	122.47	7.07	135	127.73	6.91	126	131.99	8.64	92	137.25	8.31	70	141.93	6.54
Colorado	77	101.75	5.49	88	106.09	4.70	92	109.85	6.03	114	113.39	6.43	112	118.48	6.82	105	122.98	7.31	101	129.63	7.55	85	136.29	6.74	55	139.89	6.95
District of Columbia, Maryland, and Virginia	301	102.71	4.81	354	106.94	5.27	384	111.35	6.11	376	114.68	6.44	360	119.12	6.97	324	125.12	7.65	505	131.78	7.57	500	136.32	7.10	366	138.86	6.50
Illinois	142	104.19	6.35	160	107.16	5.96	183	110.55	6.68	216	114.17	7.23	225	118.24	7.20	250	124.17	8.38	227	129.42	8.16	207	134.23	8.27	114	138.96	6.63
Iowa	223	103.08	4.17	252	106.97	4.70	220	111.59	5.69	257	115.12	5.62	258	120.40	6.80	272	125.66	7.11	130	130.70	7.70	71	134.56	7.81	55	140.22	8.55
Kansas	108	101.47	5.21	143	106.27	5.72	147	109.69	5.53	148	113.55	6.05	164	117.69	6.65	206	124.19	7.39	252	129.39	8.05	265	135.05	7.34	222	138.30	6.79
Michigan	37	102.46	6.20	43	106.44	6.17	72	111.08	6.17	82	114.34	6.25	100	118.36	7.87	95	122.53	8.22	55	126.96	7.81	24	129.00	7.82	29	137.52	7.27
Minnesota	283	101.94	4.97	239	106.63	5.58	267	110.60	6.02	341	114.78	6.48	287	119.17	6.92	271	124.61	8.08	265	131.04	8.13	309	136.03	7.08	243	139.75	5.92
Nebraska	135	102.21	5.44	137	105.81	4.60	157	110.27	5.81	189	114.31	6.29	164	118.50	6.00	138	124.46	7.73	117	128.56	7.32	83	134.25	7.14	25	140.32	6.23
Ohio	71	102.37	5.20	60	106.88	4.51	79	109.85	6.11	108	114.41	6.66	99	118.35	7.27	94	122.97	7.12	92	129.03	7.85	73	135.32	8.11	45	139.96	8.51
Pennsylvania	177	102.94	4.75	212	107.09	5.52	206	110.34	6.08	220	114.25	6.33	228	119.93	7.07	239	124.38	8.43	326	129.67	8.31	325	134.92	7.88	288	137.51	6.49
Tennessee	91	103.43	4.64	135	105.67	5.30	124	109.15	5.88	155	112.50	5.86	153	118.19	7.26	139	121.29	7.10	141	129.06	7.56	117	134.31	6.59	75	137.09	6.79
Texas	190	101.99	4.82	225	105.86	4.86	274	109.60	5.89	232	113.47	6.16	234	118.41	6.24	285	123.75	7.33	306	129.30	7.70	227	134.12	7.55	156	138.13	6.64
Utah	117	103.82	4.57	104	107.58	5.91	152	110.32	6.06	160	114.54	5.80	180	118.58	5.67	161	123.80	7.57	126	128.39	7.47	52	131.08	7.39	13	135.54	6.06

TABLE 66.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group B, girls aged 6 to 14

HIP HEIGHT

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	173	57.35	3.19	256	59.89	3.07	258	63.36	3.75	300	66.80	3.82	317	70.35	3.97	309	74.30	4.37	273	76.70	3.92	276	79.94	3.95	191	81.09	4.06
California	125	57.31	3.20	144	60.82	3.40	131	64.69	3.73	131	67.63	4.37	132	71.70	3.91	138	74.69	4.72	145	78.29	4.67	133	80.36	4.18	116	81.61	4.36
Colorado	218	56.91	3.41	232	60.32	3.63	303	64.09	3.90	278	67.30	4.00	304	70.82	4.12	263	74.15	4.02	243	76.95	4.23	180	79.33	4.21	117	81.32	7.83
District of Columbia, Maryland, and Virginia	126	57.34	3.42	160	60.31	3.76	170	62.79	3.72	173	66.59	4.47	167	70.30	4.41	151	73.34	5.17	172	77.05	4.44	137	78.95	4.51	102	79.70	4.10
Illinois	47	58.43	4.51	82	61.78	4.07	99	65.04	4.03	106	67.25	4.14	131	71.40	4.66	114	74.23	4.71	100	77.24	4.14	68	78.46	4.47	36	79.03	4.74
Iowa	222	56.42	3.10	283	59.84	3.21	272	63.32	3.78	282	66.34	3.89	284	69.28	3.88	268	72.61	4.25	191	76.25	4.11	110	78.28	4.16	79	80.28	4.06
Kansas	192	56.91	3.37	216	60.69	3.69	215	63.89	3.69	256	66.70	4.14	239	70.97	4.19	261	74.77	4.76	326	77.30	4.42	371	79.31	3.98	279	80.28	3.94
Michigan	35	57.29	3.73	46	60.52	3.51	72	64.54	4.02	76	67.74	4.42	84	72.06	4.49	92	73.41	4.21	61	76.15	3.91	35	78.14	4.10	22	81.45	3.43
Minnesota	310	56.93	3.37	319	60.70	3.74	326	64.45	3.94	357	67.61	3.97	373	70.81	4.04	363	74.08	4.29	248	76.98	4.59	288	79.74	4.05	218	80.60	3.62
Nebraska	76	57.45	4.10	73	60.55	3.43	80	64.29	3.66	78	67.26	3.67	100	70.77	4.44	55	74.16	5.07	54	76.96	4.88	35	78.80	3.50	16	80.50	5.27
Ohio	140	57.89	4.21	190	60.29	3.65	221	63.80	3.60	220	67.25	4.21	212	70.36	4.13	204	73.93	4.26	156	77.90	3.97	124	79.48	4.09	79	81.35	3.90
Pennsylvania	184	56.47	3.27	225	59.98	3.94	267	63.54	4.15	257	66.58	4.15	208	70.16	4.18	238	73.05	4.47	223	75.46	4.83	220	78.60	4.11	167	79.56	3.70
Tennessee	155	56.28	3.89	201	59.63	3.98	214	63.29	3.77	224	66.43	3.90	206	68.92	4.09	161	72.44	4.01	146	75.38	4.19	103	77.36	4.09	62	79.66	4.01
Texas	156	58.01	3.61	246	60.87	3.41	242	64.67	3.67	203	67.58	3.54	219	71.49	4.06	247	74.74	3.98	269	78.47	4.45	216	80.74	3.69	148	81.91	3.49
Utah	107	57.61	3.06	165	61.85	4.39	186	64.18	3.84	183	67.40	4.26	203	70.65	4.56	176	74.20	4.36	108	76.85	4.39	65	79.94	4.21	21	80.57	3.25

WEIGHT

Alabama	173	45.55	5.75	256	49.04	5.63	258	53.56	7.44	300	59.96	8.83	317	67.52	11.31	309	74.63	12.17	273	82.69	14.87	276	94.43	16.29	191	102.98	16.45
California	125	48.63	6.41	144	53.58	8.37	131	59.47	8.04	131	67.96	11.69	132	75.86	11.80	138	84.88	16.05	145	96.61	20.64	133	105.90	17.43	116	111.30	17.71
Colorado	218	44.33	6.11	232	49.24	6.99	303	55.06	8.08	278	61.31	10.20	304	67.12	11.32	263	74.78	14.44	243	83.79	14.92	180	92.96	15.48	117	103.14	14.43
District of Columbia, Maryland, and Virginia	126	46.31	6.28	160	49.91	6.18	170	54.08	7.87	173	60.83	11.54	167	67.76	12.63	151	75.38	14.49	172	87.25	16.75	137	97.53	16.92	102	101.98	15.98
Illinois	47	49.28	8.29	82	53.87	9.53	99	58.62	8.51	106	62.99	11.08	131	73.86	15.83	114	81.53	15.20	100	89.23	15.82	68	97.00	18.44	36	104.28	19.63
Iowa	222	45.05	5.79	283	60.88	7.44	272	56.92	9.86	282	62.52	11.15	284	68.55	12.31	268	76.28	13.35	191	88.32	15.54	110	97.25	19.65	79	104.78	18.00
Kansas	192	45.56	6.15	216	50.87	7.41	215	55.79	7.59	256	62.09	10.82	239	69.06	11.25	261	79.35	15.40	326	90.91	18.92	371	97.35	16.60	279	105.51	16.26
Michigan	35	46.49	8.32	46	51.98	7.16	72	59.03	10.70	76	62.62	10.97	84	72.40	14.75	92	76.89	12.61	61	84.84	13.16	35	91.29	13.75	22	102.55	15.49
Minnesota	310	45.23	6.60	319	51.14	8.15	326	57.29	9.44	357	62.47	9.72	373	69.91	12.04	363	79.46	14.74	248	89.24	17.04	288	100.15	16.00	218	106.68	15.63
Nebraska	76	44.95	7.38	73	49.88	7.45	80	54.68	8.41	78	59.69	8.58	100	67.34	10.46	55	78.18	17.50	54	85.59	17.48	35	92.74	14.58	16	99.88	15.51
Ohio	140	46.41	7.54	190	50.06	6.89	221	55.09	7.29	220	61.33	10.74	212	67.36	11.63	204	74.98	12.72	156	87.64	16.57	124	94.54	16.20	79	101.86	14.46
Pennsylvania	184	45.83	7.16	225	50.21	8.37	267	56.54	10.64	257	61.49	10.25	208	69.22	12.99	238	77.52	14.40	223	85.33	17.76	220	97.90	17.05	167	105.20	14.42
Tennessee	155	45.32	6.72	201	49.24	7.84	214	55.34	8.52	224	60.67	10.14	206	65.23	12.69	161	74.26	14.35	146	81.39	14.39	103	87.96	14.09	62	96.97	14.10
Texas	156	47.07	7.05	246	50.86	7.35	242	55.83	7.53	203	61.44	10.40	219	70.04	11.51	247	76.65	12.60	269	88.51	15.41	216	98.05	16.94	148	104.32	14.35
Utah	107	44.40	5.70	165	51.84	7.86	186	55.20	7.84	183	61.31	9.91	203	66.68	10.79	176	74.47	12.05	108	83.39	13.74	65	91.63	13.46	21	96.43	9.99

STATURE

Alabama	173	116.46	5.05	256	120.75	4.92	258	125.99	5.94	300	131.53	5.93	317	137.15	6.32	309	143.53	7.02	273	148.63	6.82	276	155.01	6.46	191	157.95	6.52
California	125	117.37	5.16	144	123.03	5.14	131	128.69	5.94	131	133.85	6.41	132	139.98	6.04	138	145.49	7.62	145	151.49	8.04	133	156.47	6.58	116	157.94	6.53
Colorado	218	115.66	5.48	232	121.31	5.57	303	127.26	5.68	278	132.69	6.04	304	137.76	6.49	263	143.06	7.22	243	148.62	7.38	180	153.56	6.92	117	157.86	6.28
District of Columbia, Maryland, and Virginia	126	116.58	5.52	160	120.94	5.67	170	125.12	5.56	173	130.71	6.85	167	136.71	6.84	151	142.20	7.99	172	148.98	7.07	137	153.15	7.40	102	155.02	5.93
Illinois	47	118.17	6.80	82	123.10	6.44	99	128.64	6.32	106	132.77	6.34	131	139.01	7.41	114	144.38	7.44	100	149.97	6.87	68	153.00	7.76	36	155.58	6.38
Iowa	222	115.45	4.77	283	121.29	4.84	272	126.89	6.02	282	131.56	6.47	284	137.81	6.48	268	142.46	6.56	191	149.16	7.39	110	153.77	7.88	79	158.19	6.31
Kansas	192	116.18	5.61	216	122.10	5.68	215	127.35	5.26	256	131.84	6.25	239	138.36	6.64	261	144.90	7.81	326	150.18	7.53	371	154.64	6.43	279	157.72	6.00
Michigan	35	115.83	5.80	46	122.24	5.41	72	127.47	6.12	76	131.97	5.60	84	139.10	7.28	92	142.21	7.13	61	147.64	6.84	35	151.40	6.70	22	157.50	4.74
Minnesota	310	115.74	5.55	319	121.68	5.72	326	128.00	6.07	357	132.74	5.98	373	138.03	6.75	363	144.06	6.98	248	149.79	7.45	288	155.18	6.42	218	157.42	5.88
Nebraska	76	116.29	5.99	73	121.37	5.25	80	127.13	5.80	78	132.19	5.79	100	137.60	6.70	55	143.47	8.12	54	149.11	8.19	35	152.43	7.07	16	156.81	3.71
Ohio	140	116.90	6.32	190	120.86	5.50	221	126.23	5.29	220	131.59	6.27	212	136.57	6.56	204	142.18	6.93									

TABLE 66.—Means and standard deviations (centimeters) for 7 measurements by State and age for socioeconomic group B, girls aged 6 to 14—Continued

HIP GIRTH

State	Age 6			Age 7			Age 8			Age 9			Age 10			Age 11			Age 12			Age 13			Age 14		
	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.	Number of cases	Mean	S. D.
Alabama	173	60.82	3.58	256	62.45	3.32	258	64.51	4.17	300	67.59	4.46	317	71.12	5.61	309	74.06	5.61	273	77.46	6.38	276	82.56	7.01	191	86.59	6.51
California	125	62.40	4.06	144	64.40	4.57	131	67.09	4.08	131	71.21	5.58	132	74.52	5.14	138	78.08	6.47	145	82.97	8.33	133	87.27	6.87	116	89.89	6.08
Colorado	218	59.43	3.80	232	61.94	3.94	303	64.75	4.42	278	67.92	5.15	304	70.13	5.43	263	73.44	6.43	243	77.38	6.59	180	81.47	6.92	117	85.99	5.95
District of Columbia, Maryland, and Virginia	126	60.94	3.76	160	62.47	3.59	170	64.49	4.20	173	67.45	5.65	167	70.49	6.36	151	73.87	6.45	172	79.13	7.07	137	83.82	7.16	102	85.83	6.40
Illinois	47	63.04	4.76	82	64.85	5.16	99	66.96	4.81	106	69.07	5.89	131	73.58	7.31	114	77.10	6.86	100	80.28	6.81	68	84.21	7.75	36	86.61	7.33
Iowa	222	60.22	3.64	283	63.11	4.45	272	66.00	5.19	282	68.40	5.56	284	71.09	5.99	268	74.56	6.12	191	80.03	6.76	110	83.67	8.34	79	87.23	7.50
Kansas	192	60.42	3.83	216	62.87	4.36	215	65.38	4.16	256	68.51	5.54	239	71.34	5.33	261	75.89	6.71	326	80.79	7.80	371	84.01	7.06	279	88.02	6.37
Michigan	35	60.89	4.84	46	63.24	4.25	72	66.90	5.70	76	67.91	5.39	84	72.44	6.54	92	74.71	6.48	61	77.82	6.39	35	81.40	6.76	22	85.05	6.79
Minnesota	310	59.99	3.80	319	63.09	4.63	326	65.89	4.96	357	68.35	5.03	373	71.87	5.66	363	75.59	6.52	248	79.82	7.28	288	84.56	6.48	218	87.78	6.43
Nebraska	76	59.86	4.51	73	62.77	4.43	80	64.85	4.37	78	67.18	4.31	100	70.71	4.93	55	75.42	7.62	54	78.06	7.53	35	81.97	6.54	16	84.63	6.10
Ohio	140	60.01	4.27	190	62.27	4.22	221	64.57	4.11	220	67.56	5.27	212	69.96	5.51	204	72.92	5.93	156	78.43	6.97	124	82.06	6.67	79	85.09	5.69
Pennsylvania	184	60.32	4.78	225	62.51	4.98	167	65.55	5.50	257	68.00	5.66	208	71.38	5.79	238	74.72	6.44	223	78.38	7.43	220	83.67	6.94	167	86.60	5.86
Tennessee	155	59.97	4.16	201	61.84	4.61	214	64.99	4.69	224	67.46	5.21	206	69.37	5.90	167	73.69	6.56	146	76.77	6.33	103	79.91	6.56	62	83.94	5.98
Texas	156	61.73	4.26	246	63.43	4.46	242	65.53	3.99	203	68.30	5.26	219	72.27	5.42	241	75.23	5.87	269	80.23	6.50	216	84.36	6.81	148	87.17	5.59
Utah	107	59.35	3.29	165	63.18	4.40	186	64.62	4.05	183	67.26	5.02	203	69.99	5.30	176	73.44	5.68	108	76.86	6.11	65	79.97	5.77	21	82.86	4.61

TOTAL POSTERIOR ARM LENGTH

Alabama	173	40.47	2.14	256	42.14	2.16	258	44.21	2.50	300	46.48	2.64	317	48.94	2.70	309	51.50	2.10	273	53.53	2.98	276	56.08	2.85	191	57.35	2.71
California	125	40.93	2.42	144	42.90	2.39	131	45.38	2.45	131	47.48	2.80	132	49.91	2.62	138	52.30	3.11	145	54.86	3.27	133	56.46	2.89	116	57.08	3.07
Colorado	218	40.53	2.42	232	42.65	2.41	303	45.06	2.61	278	47.32	2.73	304	49.61	2.89	263	51.88	3.13	243	53.87	3.03	180	55.92	3.07	117	57.68	3.19
District of Columbia, Maryland, and Virginia	126	40.38	2.53	160	42.07	2.53	170	43.72	2.59	173	46.28	3.12	167	48.83	3.03	151	50.88	3.70	172	53.97	3.42	137	55.74	3.38	102	56.38	2.90
Illinois	47	41.32	2.98	82	43.62	2.77	99	45.59	2.59	106	47.09	2.56	131	50.12	3.39	114	52.34	3.34	100	54.71	3.12	68	55.49	3.20	36	56.08	3.02
Iowa	222	39.86	2.10	283	42.26	2.09	272	44.53	2.91	282	46.56	2.81	284	48.67	2.74	268	51.02	3.08	191	53.60	3.11	110	55.40	3.03	79	57.35	3.04
Kansas	192	40.65	2.42	216	43.16	2.56	215	45.16	2.48	256	46.95	2.80	239	49.69	3.01	261	52.31	3.45	326	54.52	3.16	371	56.19	2.82	279	57.22	2.72
Michigan	35	40.60	2.66	46	42.78	2.63	72	45.28	2.63	76	47.36	2.63	84	50.12	3.19	92	51.89	3.13	61	53.82	2.86	35	55.20	3.03	22	58.05	2.54
Minnesota	310	40.60	2.34	319	42.88	2.44	326	46.36	2.68	357	47.39	2.83	373	49.71	2.89	363	52.15	3.05	248	54.35	3.16	288	56.51	2.83	218	57.74	2.80
Nebraska	76	40.71	2.75	73	42.68	2.27	80	45.01	2.46	78	46.92	2.53	100	49.21	2.88	55	51.75	3.42	54	53.98	3.50	35	55.06	3.13	16	57.44	4.34
Ohio	140	40.73	2.78	190	42.24	2.47	221	44.29	2.27	220	46.57	2.70	212	48.67	2.90	204	51.09	3.06	156	53.85	3.02	124	55.38	2.80	79	57.10	2.73
Pennsylvania	184	40.35	2.43	225	42.26	2.47	167	44.76	2.95	257	46.69	2.67	208	48.99	2.97	238	51.43	3.06	223	53.17	3.46	220	55.92	2.90	167	56.84	2.53
Tennessee	155	40.19	2.65	201	42.17	2.70	214	44.54	2.53	224	46.81	2.64	206	48.49	2.86	161	51.17	2.92	146	53.25	2.92	103	54.83	2.85	62	56.42	2.60
Texas	156	40.79	2.36	246	42.55	2.41	242	44.95	2.38	203	46.61	2.59	219	49.35	2.72	247	51.73	2.81	269	54.30	3.39	216	56.27	2.79	148	57.30	2.65
Utah	107	40.73	2.24	165	43.60	2.72	186	45.13	2.69	183	47.16	2.86	203	49.34	3.08	176	51.96	3.08	108	54.00	3.08	65	56.35	3.36	21	57.00	2.49

VERTICAL TRUNK GIRTH

Alabama	173	101.40	4.58	256	104.18	4.18	258	107.72	4.97	300	111.84	5.29	317	116.58	6.39	309	121.06	6.64	273	126.25	7.41	276	132.50	7.42	191	136.68	7.37
California	125	103.15	4.33	144	107.22	5.24	131	111.22	5.22	131	116.11	5.98	132	120.73	6.21	138	125.75	7.89	145	131.72	8.51	133	136.98	7.22	116	139.64	6.80
Colorado	218	100.37	5.34	232	105.89	5.09	303	109.66	5.70	278	113.97	6.35	304	117.23	6.66	263	122.22	7.77	243	127.74	8.07	180	132.80	8.05	117	138.51	6.52
District of Columbia, Maryland, and Virginia	126	102.35	5.10	160	104.70	4.26	170	107.75	5.21	173	111.97	6.63	167	116.56	6.87	151	121.05	7.82	172	128.80	7.95	137	133.90	8.04	102	137.01	7.94
Illinois	47	104.19	5.58	82	106.28	6.28	99	110.34	5.18	106	113.48	6.38	131	119.57	8.25	114	124.39	7.96	100	129.37	8.19	68	133.34	8.37	36	137.42	5.75
Iowa	222	102.22	4.28	283	106.20	5.18	272	110.30	5.86	282	113.81	6.08	284	118.43	6.67	268	122.96	7.13	191	129.52	7.94	110	134.55	8.92	79	139.22	8.00
Kansas	192	101.67	4.77	216	106.29	5.27	215	109.47	4.85	256	113.89	5.96	239	117.62	6.47	261	123.40	7.92	326	130.56	8.93	371	133.90	7.38	279	137.41	6.73
Michigan	35	101.06	6.81	46	105.61	5.60	72	109.14	6.67	76	112.20	6.02	84	118.35	7.94	92	121.08	7.28	61	126.07	7.82	35	129.49	6.86	22	135.77	7.08
Minnesota	310	101.48	4.86	319	105.96	5.43	326	110.26	5.76	357	113.84	5.87	373	118.42	6.66	363	124.21	7.94	248	129.14	7.60	288	135.27	7.06	218	138.06	7.08
Nebraska	76	101.88	4.98	73	105.78	4.96	80	109.35	4.98	78	112.86	4.74	100	117.15	6.26	55	123.40	8.48	54	128.26	9.01	35	132.49	7.98	16	136.06	7.45
Ohio	140	102.76	5.33	190	105.65	4.53	221	109.36	5.04	220	113.53	6.17	212	117.08	6.71	204	121.69	6.97	156	129.08	8.09	124	133.47	8.14	79	137.19	7.28
Pennsylvania	184	101.70	5.08	225	105.18	5.56	167	109.46	6.14	257	113.22	6.06	208	118.13	6.40	238	122.69	7.20	223	127.06	8.22	220	133.24	7.39	167	136.89	6.57
Tennessee	155	101.74	5.20	201	104.68	5.54	214	109.11	5.60	224	112.52	5.90	206	115.72	6.79	161	121.35	7.30	146	125.99	7.88	103	130.30	7.29	62	135.34	6.77
Texas	156	102.22	5.04	246	104.93	4.94	242	108.37	4.97	203	112.15	5.80	219	117.19	6.17	247	121.65	7.33	269	128.52	7.74	216	133.81	7.67	148	137.53	6.91
Utah	107	101.97	4.50	165	107.85	5.01	186	109.70	5.26	183	114.12	6.01	203	117.85	6.15	176	122.40	7.08	108	127.54	7.54	65	132.12	6.87	21	134.38	5.63

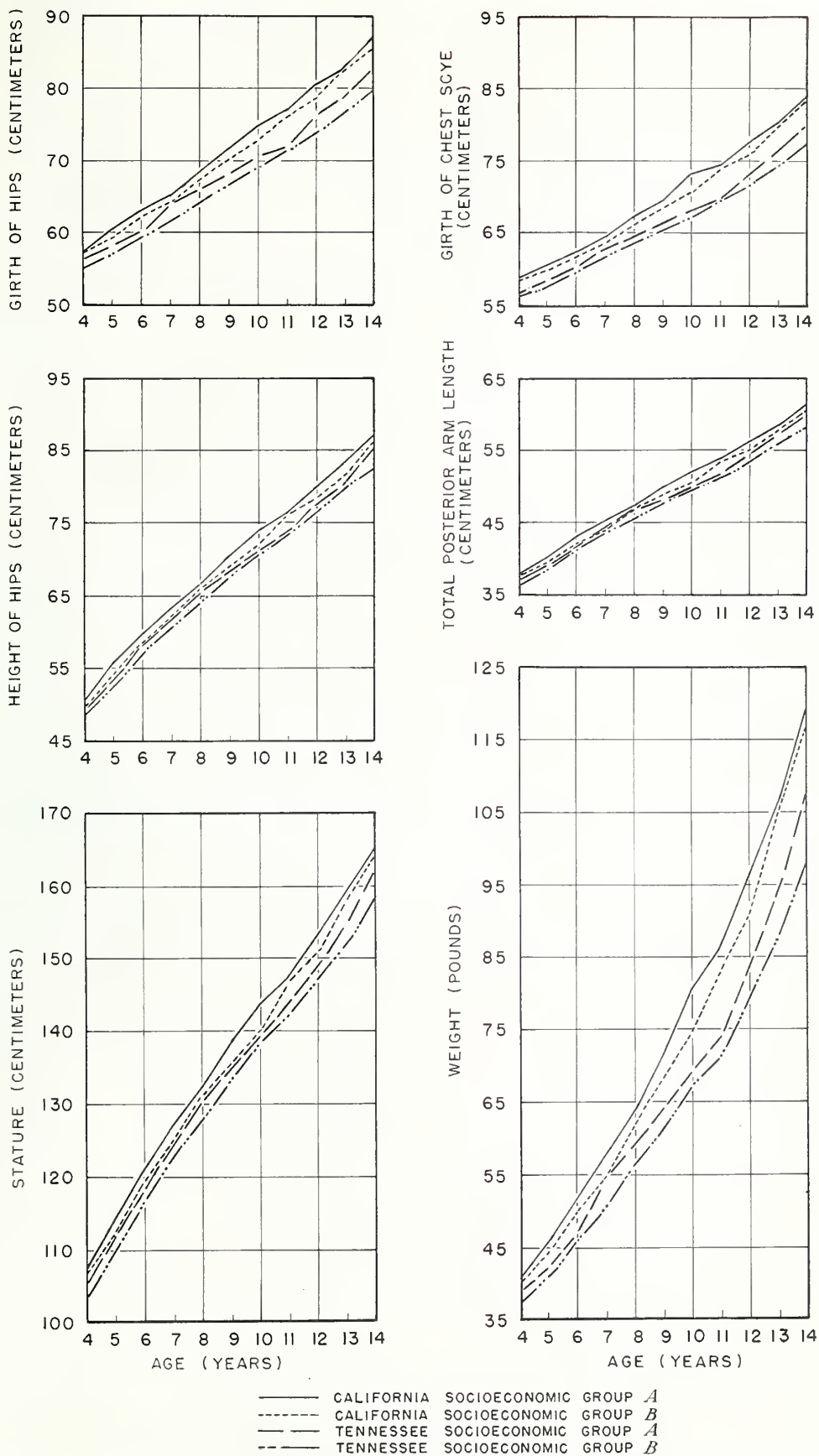


FIGURE 59.—Means of measurements of California and Tennessee boys aged 4 to 14, classified according to socioeconomic groups A and B.

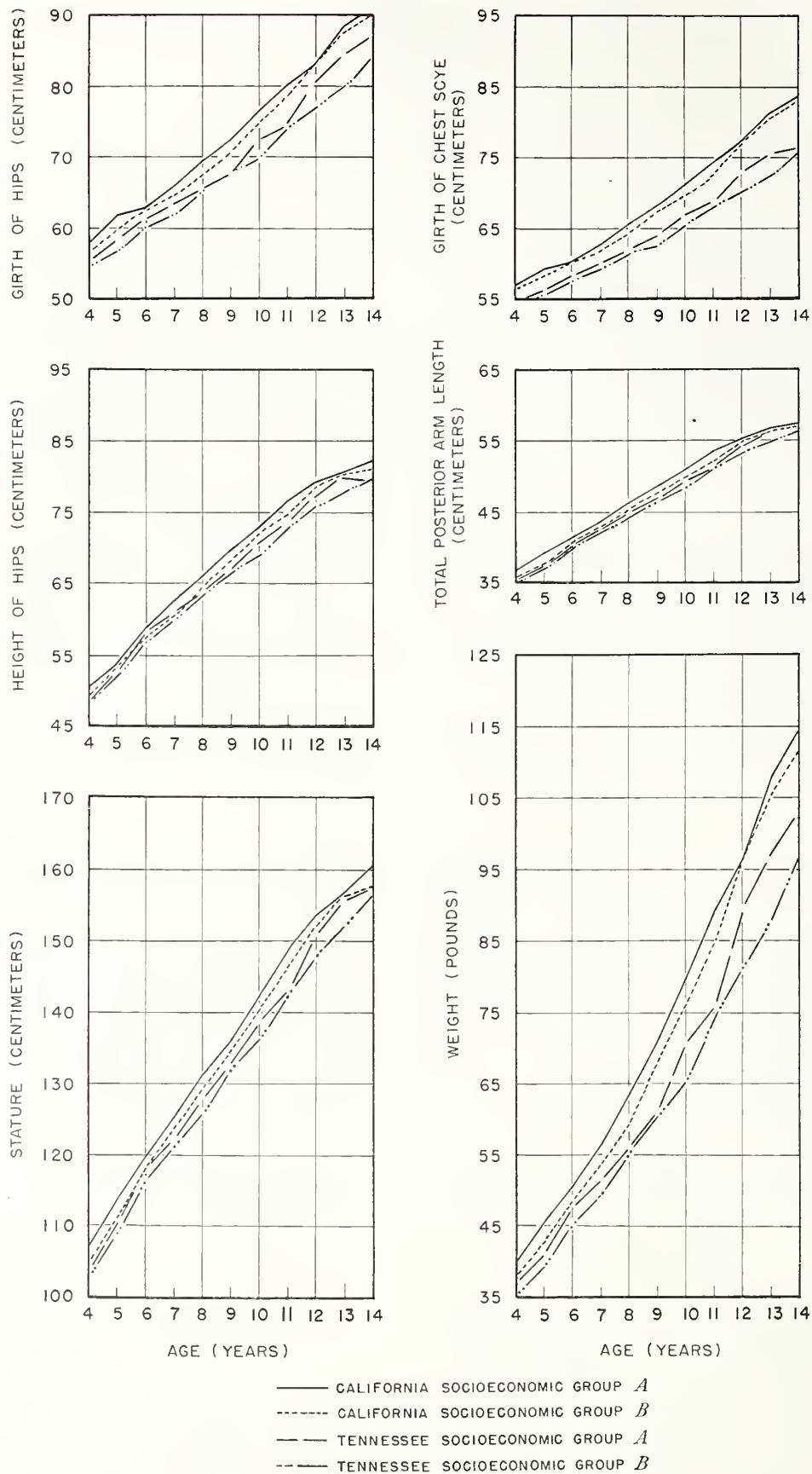


FIGURE 60.—Means of measurements of California and Tennessee girls aged 4 to 14, classified according to socioeconomic groups A and B.

# Appendix

## The Statistical Problems Involved in Sizing Garments

The first step in the formulation of any system of sizing children's patterns and garments should be to make a suitable classification of children into classes and to provide a set of body measurements for each class. From this, a form or mannequin most nearly representing the children in that group can be built. Then garments and patterns can be sized on these forms with proper allowances for underclothing, comfort, and style features. The analysis, therefore, must involve first the determination of the measurements for the series of representative mannequins and second, the development of a scheme of identifying a given child with the proper mannequin.

These two problems can be approached from a geometric point of view. Let it be assumed that  $n$  measurements, designated as  $x_1, x_2, \dots, x_n$ , are taken on every child sampled, and that these measurements are so chosen as to supply sufficient information to permit the construction of a form or mannequin. These  $n$  measurements may be considered as constituting a point in an  $n$ -dimensional space so that every child will be characterized by a point in that space.

Thus a random sample of children can be thought of as forming a swarm or cluster of points in the  $n$ -dimensional space. The nature of this cluster will depend on the size of the sample and the probability density of the measurements. The probability density of the measurements may be assumed to be given by some function  $f(x_1, x_2, \dots, x_n)$ . The probability that a child picked at random will have a set of  $n$  measurements lying in a specified region of the  $n$ -dimensional space will then be given by the integral of the function  $f$  over that region.

It is obviously neither necessary nor economical to set up a separate size standard (i. e. mannequin) for each point of the cluster. What is required is the selection of a specified number of points within this cluster that are a given "distance" <sup>2</sup> from each other. These selected points may be designated as "standard points."

Since a child is specified exactly by  $n$  measurements, he may be identified with that standard point in the  $n$ -dimensional space that is nearest to him. In fact, the standard points may be surrounded by nonoverlapping  $n$ -dimensional regions such as intervals <sup>3</sup>, and the convention adopted that a child whose measurements lie in one of these regions is to be designated by the standard point of that region. But such a scheme would require the knowledge of all the  $n$  measurements of a child before he could be identified with the proper mannequin. This would make sizing garments a formidable task.

Had body measurements been independently distributed, (i. e., if  $f(x_1, x_2, \dots, x_n)$  were equal to a product of the functions of  $f_1(x_1), f_2(x_2), \dots, f_n(x_n)$  where  $f_i(x_i)$  is the probability density of the measurement  $x_i$ ), then essentially there would exist no alternative to the above scheme. Fortunately, body measurements are related to each other and it is possible to identify a child with the proper standard point by the knowledge of only a few of his measurements.

This can be shown by considering a concrete representation of the cluster of points in the  $n$ -dimensional space discussed above. Such a representation is given by a random sample of children assembled in one place. The problem then can be posed in the following manner: Assuming that a set of  $k$  distinct mannequins is given, segregate the children into  $k$  groups around

<sup>1</sup> This function is nonnegative and its integral over the entire space is unity.  
<sup>2</sup> If the measurements were uncorrelated, the usual definition of distance between any two points in an  $n$ -dimensional space could be employed here. For correlated measurements a more appropriate metric could be defined in the following way. Let  $(a_1, a_2, \dots, a_n)$  be a standard point in the  $n$ -dimensional space, and let  $(x_1, x_2, \dots, x_n)$  be any other point representing a set of measurements on a child. Furthermore, let  $\sigma_{ij}$  be the covariance of  $x_i$  and  $x_j$ . Then the square of the distance between

the point  $(x_1, x_2, \dots, x_n)$  and  $(a_1, a_2, \dots, a_n)$  may be taken as  $\sum_{i=1}^n \sum_{j=1}^n \sigma_{ij} (x_i - a_i)(x_j - a_j)$  where  $\sigma_{ij}$  is the element in the  $i$ th row and  $j$ th column of the inverse of the matrix determined by the elements  $\sigma_{ij}$ .

<sup>3</sup> An interval is an  $n$ -dimensional rectangle defined by values of  $x_i$  such that  $A_i \leq x_i < B_i$ ; ( $i=1, 2, \dots, n$ ) where  $A_i$  and  $B_i$  are definite numbers.

each of the mannequins in such a way that the children of a given group differ as little as possible from the corresponding mannequin. This may be accomplished by choosing a measurement  $x$  and identifying a child with that mannequin for which the difference between the value of  $x$  for the mannequin and that of the child is smaller in absolute value than for any other mannequin of the set. The measurement  $x$  so treated may be termed a "control variable."

Having chosen  $x$ , let it be assumed that a criterion can be constructed that will measure the departure of the remaining measurements of the children in a particular group, defined by the measurement  $x$ , from the corresponding measurements of the mannequin representative of that group. With the possession of such a criterion it would be possible to compare the efficacy of one control variable (such as  $x$ ) with that of other possible control variables. By this method a control variable (or control variables) may be found that segregate the children into groups such that, for each group, the departure of the measurements of the children from the corresponding measurements of the mannequin are within acceptable limits. Such a control variable or variables can be used to the exclusion of all other measurements to identify a child with the proper mannequin.

A statistical counterpart to the above scheme of identifying a child with the proper standard point from the knowledge of only a few of the measurements is as follows:

Let  $x_1, \dots, x_s; y_1, \dots, y_t$  ( $s+t=n$ ) represent the coordinate of the measurements of a child or mannequin in  $n$ -dimensional space. Let  $a_1, a_2, \dots, a_s$ , be particular values of the  $x_1, \dots, x_s$  coordinates that characterize a given mannequin. Further, let  $P$  represent the population of children whose  $x_1, \dots, x_s$  coordinates are  $a_1, a_2, \dots, a_s$ . It is desired to study the distribution of  $y_1, y_2, \dots, y_t$  within the cluster in the  $n(=t+s)$ -dimensional space for the given values  $a_1, a_2, \dots, a_s$  of  $x_1, x_2, \dots, x_s$ . Geometrically, this corresponds to studying the cluster within a  $t$ -dimensional plane perpendicular at  $a_1, a_2, \dots, a_s$  to the  $s$ -dimensional plane defined by  $x_1, x_2, \dots, x_s$ . The shape of the cluster in the  $t$ -dimensional plane will depend on the relationship of the two sets of measurements  $x_1, \dots, x_s$ , and  $y_1, y_2, \dots, y_t$  as determined by the original distribution function  $f(x_1, \dots, x_s, y_1, \dots, y_t)$ . If  $f$  has the multivariate normal form, then the distribution of  $y_1, y_2, \dots, y_t$  will also be multivariate normal. However, even if  $f$  is not normal, the resulting distribution may not depart too far from normality. In either case, the distribution may be well characterized by the set of means, variances and covariances <sup>4</sup> of the  $t$  measurements lying in the  $t$ -dimensional plane.

It would seem reasonable that if one were to choose a given number of control measurements they should be so chosen that the scatter of the remaining measurements in the residual space is as small as possible. From a statistical point of view, a good measure of this scatter in the residual space seems to be the residual generalized variance.<sup>5</sup>

That the generalized variance is an appropriate measure of the scatter, particularly when dealing with normally distributed variates, may be seen from the following considerations. Like the variance of a single variable that measures the concentration of a distribution in a one-dimensional space around a point, the generalized variance of  $p$  variates measures the concentra-

<sup>4</sup> The population variance of a variate  $y_i$  is defined as the expected value of  $(y_i - m_i)^2$  and the population covariance of two variates  $y_i$  and  $y_j$  is defined as the expected value of  $(y_i - m_i)(y_j - m_j)$ , where  $m_i$  and  $m_j$  are the population means of  $y_i$  and  $y_j$  respectively. The population means,  $m_i$  and  $m_j$ , may be constants or functions of  $s$  other variables, say  $x_1, x_2, \dots, x_s$ . The latter will be the case, for instance, if  $y_i, y_j$  and  $x_1, x_2, \dots, x_s$  have a joint normal distribution and the means of  $y_i$  and  $y_j$  for given values of  $x_1, x_2, \dots, x_s$  are considered.

The best unbiased estimates of the population variances and covariances are given by the formulae  $\frac{\sum (y_i - \bar{y}_i)^2}{N - s - 1}$  and  $\frac{\sum (y_i - \bar{y}_i)(y_j - \bar{y}_j)}{N - s - 1}$  respectively where the symbol  $\sum$  stands for summation over the entire sample,  $N$  is the number of cases in the sample and  $\bar{y}_i$  and  $\bar{y}_j$  are the least-squares estimates of  $m_i$  and  $m_j$  respectively. If  $s$  equals zero, then  $\bar{y}_i$  and  $\bar{y}_j$  are the sample means or averages of  $y_i$  and  $y_j$  respectively. If  $s$  is not equal to zero, they are the regression formulae (given by the least-squares method) of the corresponding  $y$ 's on the set of  $s$   $x$ 's.

<sup>5</sup> The generalized variance of a set of  $t$  variates is defined as the determinant of variances and covariances of these variates. If each of the  $t$  variates is a linear function, determined by the least-squares method, of  $s$  other variates, then the residual generalized variance of the  $t$  variates is defined as the determinant of variances and covariances calculated from deviations from these regression equations.

tion of the distribution of the  $p$  variates in a space of dimension lower than  $p$ . Again, it is known that if  $\sigma_y^2$  is the variance of  $y$  and  $\sigma_{y \cdot x_1 \dots x_s}^2$  is the residual variance of  $y$  holding  $x_1, x_2, \dots, x_s$  constant, then  $\sigma_{y \cdot x_1 \dots x_s}^2 = \sigma_y^2 (1 - \rho^2)$  where  $\rho$  is the multiple correlation between  $y$  and  $x_1$  to  $x_s$ . Similarly, if  $V_y$  is the generalized variance of  $y_1, y_2, \dots, y_s$  and  $V_{y \cdot x}$  is the residual generalized variance of  $y_1$  to  $y_s$  holding  $x_1$  to  $x_s$  constant, then  $V_{y \cdot x} = V_y (1 - \rho_1^2) (1 - \rho_2^2) \dots (1 - \rho_s^2)$  where  $\rho_1, \rho_2, \dots, \rho_s$  are the canonical correlations (6).

If the two sets are completely independent, the canonical correlations will be zero. Consequently no reduction in the generalized variance will result from the knowledge of  $x_1, x_2, \dots, x_s$ . The more highly the two sets are related the greater will be the reduction of  $V_{y \cdot x}$ . If  $t=1$  then  $V_{y \cdot x}$  reduces to the case where there is only one variate in one of the sets.

In the light of the above properties that the generalized variance has in common with the variance of a single variate<sup>6</sup> it would seem proper to use it as a measure of scatter.

The preceding considerations have pointed the way to the formulation of a more precise definition of what constitutes, from a statistical point of view, the best control measurements. This definition may be stated thus: That measurement or combination of measurements will be called the best control that yields a minimum residual generalized variance of the remaining measurements of the set. Since the generalized variance is not invariant under a change in scale, this definition is obviously meaningless unless it is further stipulated that the unit of measurement remain the same throughout the analysis.<sup>7</sup> Moreover, it is to be pointed out that the generalized variance of residuals as a measure of the effectiveness of different control variates must be restricted to one and the same set of variates, which does not include the variates under comparison.

Since the calculation of the generalized variances of a large set of variates is usually very laborious, piecemeal analyses employing simple, partial, and multiple correlations and other well known statistical techniques generally have been used to determine the control measurements. However, the aim, from a statistical point of view, was to select a set of variables that would yield as small a residual generalized variance as possible.

The definition as stated implies comparisons between each of the possible sets of control measurements. However, not every measurement need be tried as a possible control measurement. A great many could be discarded before the analysis began. Previous experience and considerations of practicability give some guidance. From experience, it has been learned that it is very difficult to take some measurements accurately. From a practical viewpoint, no measurement should be considered as a control unless it can be easily taken on a child by a layman using the simplest type of a measuring instrument. Again, from a practical viewpoint, the number of control measurements should not exceed two or possibly three. The measurements chosen for controls should preferably have ranges as large as possible. The latter is important since, in general, the larger the ranges of the control measurements, the less ambiguous and the more discriminating the sizing scheme.

Although in the previous discussion it was assumed that the mannequins were given a priori, actually in this study it is neces-

<sup>6</sup> The following are other similarities between the variance of a single variate and the generalized variance which may be of some interest.

(1) In the case of a single variate, Chebycheff's theorem states that the probability  $P$  that the quantity  $(x-m)^2$  will be less than  $\sigma^2$  is greater than  $1 - \frac{1}{t^2}$  no matter what the distribution of  $x$  is provided  $\sigma^2$  is finite. Here  $m$  is the mean of  $x$ ,  $\sigma^2$  the variance of  $x$ , and  $t$  any arbitrary number greater than 1. Similarly, if  $a$  is the generalized variance of the variates  $x_1, x_2, \dots, x_p$  and  $m_1, \dots, m_p$  are their corresponding means, then it can be shown that the probability that the quadratic form

$$\sum_{i=1}^p \sum_{j=1}^p A_{ij} (x_i - m_i) (x_j - m_j) \text{ will be less than } a t^2 \text{ is greater than } 1 - \frac{p}{t^2} \text{ no matter}$$

what the joint distribution of  $x_i (i=1, 2, \dots, p)$  is provided the  $\sigma_{ii}$  are finite and the determinant  $a$  is greater than zero. The quantity  $A_{ij}$  is here defined as the cofactor of the element in the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column in the determinant  $a$ , and  $t$  is any arbitrary number greater than  $p$ .

(2) Consider two sets of variates  $x_1, x_2, \dots, x_s$  and  $y_1, y_2, \dots, y_t$ . Let  $v_i = y_i - \sum_{\alpha=1}^s a_{i\alpha} x_\alpha (i=1, 2, \dots, t)$ . In the usual least-squares method, the coefficients  $a_{i\alpha}$  for any given  $i$  are determined by minimizing the variance of  $v_i$ .

It is interesting to note that coefficients  $a_{i\alpha}$  so determined for each  $i$  also minimize the generalized variance of the set of  $v$ 's. Thus the least-squares method not only minimizes the variances of each of the  $v$ 's separately but also the determinant of variances and covariances (and consequently all of its principal minors) of the whole set of  $v$ 's. This property of the least-squares method seems to be new.

<sup>7</sup> Reference is here made only to the dependent variables. The independent (i. e. the control) variables may be transformed by a linear transformation to any scale whatever without affecting the residual generalized variance of the remaining variables. Thus, if two variates  $x_1$  and  $x_2$  of entirely different variances are compared as controls, both of them may be reduced to standard units without affecting the residual generalized variances of the remaining measurements  $y_1$  to  $y_s$ .

sary to determine mannequins from the sampled data. To this end the control measurements are first chosen by the method outlined above.

Having chosen the control measurements, it is possible to define a set of mannequins parametrically by means of regressions on these control variables. Alternatively, the region defined by the joint distribution of the control variates may be considered to be a collection of subregions. Each of these subregions would determine a population of children. For example, if weight is the only control, then the children who weigh between 50 and 60 pounds may be considered as one population; children who weigh between 60 and 70 pounds, another population, and so on. For each such subregion, a representative statistic, such as an arithmetic mean, may be calculated for each of the remaining measurements of the corresponding subregion. These statistics will constitute the dimensions of the mannequin.

The concluding paragraphs of this discussion are devoted to clarifying some of the notions considered, namely: Populations, control measurements, selection of representative mannequins, and control of variation.

The garment industry has traditionally designated children's garment sizes by age. In this scheme a population is defined by means of a year interval and age is used as a control variable. In order to set up a standard mannequin for each age group, it is possible to calculate the averages of all the measurements for any given age group on the basis of some representative sample. If  $k$  age groups are involved, these age averages would determine  $k$  points in a space of  $n$  dimensions.

While the garment industry uses age as a basis for designating children's garments, there is evidence that age is used purely as a label without reference to any statistics that would characterize the population of children of a given age. For example, there are a great variety of different dimensions in the same garments labeled with the same age size designation.

But even if some statistic (such as age averages), characterizing an age population were obtained on the basis of a representative sample, it would not necessarily follow that age is a good control measurement. Knowing a child's age and nothing else about him, it may very well be that his  $n$  measurements will constitute a point far removed from the standard point defined by the averages. Or, speaking statistically, if a child of a given age is picked at random, the probability that he will lie in an admissible interval around the standard point may be very small. The situation may not necessarily be remedied by using smaller age intervals such as 6 rather than 12 months. For if age is not highly correlated with the body measurements the variations of the body measurements will remain large no matter how much the age interval is reduced.

## Other Size Norms Based on Height and Hip

The proposed standard system of sizes given on pages 45 to 49 was calculated on the basis of height-hip girth intervals. The intervals chosen give, in general, a difference of approximately 2 inches in height and 1½ inches in hip girth from size to size. If it should ever become necessary to set up a sizing scheme based on combinations of height and hip values other than those given in tables 23 to 26, the values for the other 32 measurements might be interpolated from these tables. However, such interpolations would entail a great deal of work. Also they probably would yield only rough approximations to the values of the corresponding measurements for the selected value of height and hip.

In order to facilitate the calculations and to obtain more exact estimations of the values for 32 out of 34 remaining measurements<sup>8</sup> on the basis of selected values of height and hip girth, tables 67 and 68 are presented.<sup>9</sup> These tables make it possible to find, for any selected height (in inches) within the range of this study and any integral multiple of half inch in hip girth (ranging from 20 to 39 inches), the corresponding values of the other 32 measurements.

<sup>8</sup> Maximum chest girth and height of crotch do not appear in these tables. These were left out because the number of cases in each hip interval for those measurements differed greatly from those of the other measurements. This fact made the necessary calculations too difficult to be carried out in the time allotted.

<sup>9</sup> The following statistical procedures were used in calculating these tables. For each centimeter interval of hip girth the regression equation of each of 32 measurements on height was calculated. Since, on the whole, these regression equations were found to be linear, the result yielded, for each of the hip intervals, 2 regression coefficients— $a$  and  $b$ —for each of the 32 measurements.  $b$  represents the slope and  $a$  represents the intercept. Thus, in mathematical terms, the regression equation can be written as  $y_h = a_h + b_h x$ . In this equation  $y_h$  represents the predicted value of a given measurement,  $y$ , for the hip-girth interval  $h$ ;  $b_h$  is the coefficient of height (represented by the variable  $x$ ) for the hip interval  $h$ ; and  $a_h$  is the constant term for the hip interval  $h$ . These coefficients were then smoothed by means of orthogonal polynomials and linear interpolations were made for integral multiples of one-half inch in hip girth.



TABLE 67.—Regression coefficients *a* and *b* (for boys) for use in calculating the values for any one of the 32 measurements for specified hip values in combination with any height values

Hip girth (inches)	Waist height (inches)		Hip height (inches)		Weight (pounds)		Cervicale height (inches)		Tibiale height (inches)		Bitrochanteric diameter (inches)		Shoulder slope (degrees)		Anterior chest width (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	-5.319	0.725	-6.307	0.628	-0.967	0.857	-2.505	0.878	-2.530	0.322	5.123	0.052	27.539	-0.058	5.214	0.057
20½	-6.371	.750	-6.269	.626	-3.296	.928	-3.512	.904	-3.962	.355	5.064	.057	27.940	-.074	5.867	.042
21	-5.097	.720	-6.370	.629	-2.158	.821	-2.069	.870	-2.025	.309	5.363	.051	27.110	-.041	5.181	.061
21½	-4.511	.705	-5.945	.617	1.131	.868	-1.810	.864	-1.765	.303	5.715	.045	27.766	-.051	4.619	.076
22	-4.853	.723	-5.767	.614	1.882	.882	-1.981	.879	-1.960	.308	5.935	.044	27.287	-.035	4.623	.078
22½	-5.737	.733	-6.792	.635	.533	.963	-2.796	.888	-2.431	.319	5.902	.047	26.700	-.024	4.534	.081
23	-5.306	.724	-6.509	.631	.904	.960	-2.203	.875	-2.314	.316	6.287	.041	28.893	-.071	4.829	.076
23½	-5.480	.727	-6.551	.630	-2.080	1.053	-2.152	.874	-2.668	.324	6.279	.044	29.883	-.090	4.554	.084
24	-5.446	.726	-7.192	.643	-3.155	1.104	-2.300	.878	-2.792	.327	6.178	.049	30.023	-.090	4.309	.091
24½	-5.829	.734	-7.653	.651	.625	1.058	-2.564	.884	-2.980	.330	6.464	.046	30.653	-.104	4.503	.089
25	-5.994	.738	-7.678	.652	2.459	1.053	-2.766	.888	-2.857	.328	6.862	.040	31.526	-.121	4.740	.085
25½	-6.462	.747	-8.142	.661	2.555	1.085	-3.408	.902	-2.772	.327	6.984	.040	30.937	-.111	4.755	.086
26	-7.051	.758	-8.982	.676	2.138	1.126	-4.018	.914	-2.952	.330	6.799	.047	29.671	-.084	4.895	.086
26½	-6.759	.753	-8.945	.675	-1.760	1.215	-4.288	.919	-3.409	.339	6.608	.053	30.368	-.095	4.719	.091
27	-6.674	.751	-8.839	.673	.490	1.244	-4.445	.922	-3.546	.341	6.754	.052	31.184	-.113	4.816	.091
27½	-6.352	.746	-8.358	.664	.657	1.258	-4.402	.922	-3.546	.341	6.959	.051	31.292	-.115	5.016	.089
28	-6.226	.743	-8.256	.661	1.353	1.284	-4.440	.922	-3.223	.339	7.078	.051	29.130	-.077	5.006	.090
28½	-6.180	.742	-8.642	.668	2.841	1.294	-4.486	.924	-3.665	.343	7.472	.047	29.384	-.078	5.289	.087
29	-5.815	.736	-8.598	.667	1.440	1.355	-4.659	.927	-3.467	.340	7.633	.047	30.619	-.103	5.415	.086
29½	-5.252	.726	-8.145	.658	.506	1.411	-4.464	.924	-3.096	.334	7.532	.051	29.801	-.088	5.590	.085
30	-4.516	.714	-7.138	.641	1.807	1.429	-4.011	.917	-3.025	.332	7.647	.051	28.662	-.066	5.781	.083
30½	-3.840	.702	-6.641	.633	2.357	1.462	-3.863	.914	-2.813	.329	7.747	.051	26.516	-.030	5.569	.088
31	-2.857	.685	-6.305	.626	-1.02	1.545	-3.899	.915	-2.200	.319	7.836	.053	24.833	-.002	5.402	.093
31½	-1.958	.671	-5.625	.614	-1.722	1.600	-3.797	.913	-1.618	.309	7.836	.053	24.833	-.002	5.402	.093
32	-1.230	.658	-5.184	.605	1.260	1.612	-3.749	.912	-1.317	.304	7.880	.057	23.826	.018	5.021	.103
32½	-.670	.648	-4.467	.593	3.249	1.626	-3.689	.912	-.865	.296	7.981	.058	21.454	.055	4.896	.107
33	.046	.636	-3.552	.576	5.593	1.635	-3.262	.905	-.270	.285	8.203	.060	21.143	.059	4.661	.107
33½	.914	.622	-2.366	.557	7.267	1.661	-3.067	.902	.042	.280	8.004	.061	20.047	.077	4.550	.116
34	1.033	.619	-1.816	.547	11.246	1.650	-2.731	.897	.357	.274	8.433	.058	21.237	.057	4.698	.116
34½	.972	.620	-1.714	.545	13.141	1.672	-2.524	.893	.370	.274	8.615	.057	21.482	.056	4.862	.115
35	1.159	.617	-1.670	.544	12.923	1.721	-2.511	.893	.353	.274	8.811	.056	19.038	.092	5.145	.112
35½	.795	.621	-2.114	.549	16.382	1.726	-2.407	.892	.508	.271	9.010	.055	18.567	.098	5.475	.109
36	.045	.632	-2.551	.550	21.890	1.700	-2.478	.893	.226	.275	9.046	.057	19.000	.093	5.649	.108
36½	-.699	.643	-3.244	.564	22.597	1.740	-2.440	.893	.718	.283	9.217	.056	17.202	.116	6.236	.110
37	-.425	.639	-2.625	.555	17.810	1.864	-2.496	.893	-.377	.285	9.638	.052	15.368	.143	5.720	.101
37½	.041	.634	-1.323	.536	18.835	1.903	-2.335	.892	.273	.285	10.087	.048	11.145	.199	5.572	.114
38	.055	.633	-.524	.524	32.026	1.767	-1.985	.887	.988	.265	10.065	.046	9.782	.225	6.991	.094
38½	.107	.632	-.741	.527	33.699	1.796	-2.099	.889	.847	.268	10.355	.046	12.285	.187	6.695	.099
39	.208	.631	-1.073	.532	23.074	1.990	-2.786	.899	-.578	.288	11.664	.029	16.274	.127	5.955	.111

Hip girth (inches)	Anterior waist length (inches)		Posterior chest width (inches)		Posterior waist length (inches)		Chest girth at armscye (inches)		Sceye depth (inches)		Posterior hip arc (inches)		Anterior chest arc (inches)		Waist girth (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	4.246	0.108	5.630	0.083	2.962	0.158	16.172	0.124	1.678	0.069	8.431	0.034	8.491	0.064	20.591	-0.033
20½	4.987	.089	5.931	.076	2.843	.161	15.516	.145	1.233	.082	7.196	.068	8.181	.072	20.801	-.034
21	4.104	.112	5.576	.088	3.117	.155	16.904	.117	1.926	.065	9.394	.021	8.643	.063	20.992	-.032
21½	3.132	.137	5.104	.102	2.723	.165	17.835	.101	2.031	.064	10.284	.005	9.098	.056	21.157	-.030
22	3.424	.131	4.433	.119	2.731	.166	18.083	.102	1.802	.069	10.562	.005	9.265	.055	21.296	-.025
22½	3.292	.134	4.930	.108	2.616	.169	17.430	.123	1.504	.076	11.025	-.001	9.188	.062	21.431	-.022
23	3.479	.131	5.980	.097	3.117	.158	17.693	.122	1.779	.071	11.803	-.013	9.333	.061	22.226	-.033
23½	3.942	.122	5.567	.097	3.413	.152	17.553	.131	1.732	.072	12.076	-.013	9.025	.071	21.108	-.024
24	3.996	.122	5.602	.098	3.230	.157	17.158	.145	1.722	.073	12.021	-.007	9.019	.075	21.988	-.016
24½	4.098	.120	5.952	.092	3.427	.153	17.648	.140	2.088	.067	12.735	-.016	9.111	.076	22.716	-.025
25	4.372	.115	6.001	.092	3.418	.154	17.899	.140	2.434	.060	13.505	-.027	9.577	.070	23.303	-.031
25½	4.834	.108	6.334	.087	3.448	.154	18.027	.144	2.474	.060	14.142	-.034	10.072	.063	23.533	-.030
26	5.255	.100	6.721	.081	3.716	.150	18.694	.136	2.336	.063	14.140	-.028	10.497	.058	23.762	-.029
26½	4.968	.106	6.654	.084	3.399	.156	18.435	.146	2.078	.069	14.038	-.021	10.239	.067	23.731	-.023
27	5.286	.101	6.677	.084	3.242	.160	18.818	.145	2.055	.069	14.558	-.026	10.744	.061	24.026	-.023
27½	5.511	.097	6.903	.082	3.087	.163	19.404	.139	2.121	.069	14.945	-.028	11.271	.054	24.417	-.024
28	5.248	.103	6.954	.082	2.810	.168	19.777	.138	2.194	.068	15.417	-.031	11.285	.058	25.335	-.035
28½	5.076	.107	7.118	.081	2.532	.174	20.106	.137	2.453	.064	16.058	-.038	11.551	.056	25.723	-.036
29	5.088	.107	6.862	.086	2.273	.179	20.335	.138	2.190	.069	16.759	-.045	11.707	.056	25.613	-.029
29½	4.874	.112	6.757	.089	2.172	.181	20.818	.136	1.858	.075	17.189	-.048	11.815	.058	26.255	-.035
30	4.490	.119	6.910	.088	2.062	.183	21.286	.133	1.963	.074	17.326	-.045	12.408	.051	27.898	-.057
30½	4.137	.126	6.741	.092	1.661	.191	21.925	.128	1.882	.076	17.376	-.042	12.992	.045	29.566	-.079
31	3.268	.141	6.827	.091	.901	.204	21.355	.144	1.733	.080	17.262	-.036	12.400	.058	30.012	-.080
31½	2.591	.153	6.565	.097	.408	.213	21.296	.150	1.564	.083	17.658	-.037	12.512	.060	30.886	-.081
32	2.439	.156	6.137	.106	-.131	.222	21.672	.151	1.294	.088	18.122	-.041	13.284	.051	31.227	-.088
32½	2.235	.160	5.951	.110	-.466	.228	22.168	.150	.977	.094	18.397	-.041	13.226	.056	32.616	-.104
33	1.688	.170	5.908	.112	-1.140	.240	22.728	.150	.870	.096	18.385	-.036	13.251	.059	33.985	-.119
33½	1.377	.176	5.452	.123	-1.235	.243	22.099	.165	1.666	.094	18.481	-.034	13.341	.062	34.633	-.125
34	1.312	.178	5.454	.124	-1.382	.246	22.225	.169	.906	.097	18.646	-.032	13.323	.065	35.702	-.134
34½	1.334	.178	6.329	.119	-1.519	.249	24.103	.147	.674	.101	19.041	-.034	14.036	.058	36.642	-.142
35	1.406	.177	6.754	.107	-1.373	.247	24.662	.144	.589	.103	19.045	-.029	14.286	.057	36.991	-.142
35½	1.649	.174	6.734	.109	-.974	.242	24.962	.146	.738	.102	18.958	-.024	14.147	.063	37.481	-.143
36	2.024	.170	7.015	.107	-.342	.234	26.316	.133	1.037	.097	19.654	-.020	14.937	.055	38.354	-.149
36½	2.363	.165	6.7													

TABLE 67.—Regression coefficients *a* and *b* (for boys) for use in calculating the values for any one of the 32 measurements for specified hip values in combination with any height values—Continued

Hip girth (inches)	Neck-hase girth (inches)		Shoulder length (inches)		Armseye girth (inches)		Upper-arm girth (inches)		Elbow girth (inches)		Upper posterior arm length (inches)		Total posterior arm length (inches)		Trunk line (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	8.412	0.052	0.770	0.047	7.071	0.061	7.711	-0.043	5.550	0.027	-0.487	0.208	-1.291	0.378	0.549	0.107
20½	8.762	.046	1.005	.041	6.841	.070	7.945	-.046	5.231	.030	-.622	.210	-.374	.356	.923	.098
21	8.593	.053	.721	.049	7.474	.056	7.989	-.043	6.069	.021	-.440	.207	-.225	.356	.461	.110
21½	8.507	.058	.426	.056	7.199	.067	8.130	-.043	5.756	.031	-.120	.199	-.235	.354	.443	.110
22	8.794	.053	.437	.055	7.159	.071	8.475	-.048	5.748	.034	-.180	.193	-.077	.348	.609	.106
22½	8.635	.059	.531	.054	7.040	.076	8.511	-.045	5.695	.037	-.406	.207	-.665	.366	.163	.115
23	8.640	.061	.645	.052	7.405	.071	8.652	-.045	5.764	.038	-.343	.206	-.253	.357	.233	.114
23½	8.437	.067	.665	.052	7.200	.079	8.548	-.039	5.771	.039	-.481	.209	-.433	.361	.687	.103
24	8.396	.069	.414	.057	6.829	.089	8.591	-.037	5.931	.038	-.561	.211	-1.010	.374	.709	.103
24½	8.711	.064	.610	.053	7.057	.087	9.036	-.043	6.037	.038	-.536	.210	-1.045	.375	.908	.098
25	8.901	.062	.727	.051	7.227	.086	9.171	-.043	6.002	.041	-.534	.211	-.935	.373	1.040	.096
25½	8.904	.063	.659	.053	7.187	.090	9.216	-.040	6.063	.042	-.524	.211	-.988	.375	1.022	.097
26	9.034	.062	.795	.051	7.114	.094	9.374	-.040	5.994	.045	-.722	.215	-1.538	.387	1.190	.094
26½	8.918	.066	.924	.049	6.982	.099	9.282	-.035	5.769	.051	-.867	.218	-1.840	.393	1.048	.096
27	8.895	.068	1.013	.047	7.296	.095	9.598	-.037	5.914	.050	-.849	.218	-1.572	.388	.856	.100
27½	9.138	.065	1.027	.048	7.704	.091	9.896	-.040	6.228	.046	-.747	.217	-1.180	.382	.890	.098
28	9.182	.065	.768	.052	7.812	.092	10.188	-.042	6.292	.047	-.778	.218	-1.235	.383	.813	.100
28½	9.110	.068	.945	.050	7.811	.094	10.621	-.047	6.182	.051	-.882	.220	-1.445	.387	.478	.106
29	8.926	.072	1.053	.048	7.692	.098	10.861	-.048	6.081	.055	-.807	.219	-1.445	.388	.200	.111
29½	8.850	.075	.931	.050	7.945	.097	10.879	-.045	5.995	.058	-.657	.219	-1.340	.387	.037	.113
30	8.679	.079	.904	.051	8.299	.093	11.292	-.049	6.099	.058	-.455	.214	-1.178	.385	-.209	.118
30½	8.336	.087	.845	.052	8.272	.096	11.722	-.053	6.182	.058	-.385	.212	-1.039	.382	-.759	.127
31	7.768	.098	.705	.055	8.000	.103	11.573	-.047	6.027	.063	-.310	.204	-.612	.376	-1.611	.140
31½	6.988	.113	.675	.055	8.026	.106	11.522	-.043	5.905	.066	-.333	.201	-.128	.366	-1.966	.146
32	6.210	.127	.646	.056	8.284	.104	11.857	-.046	6.114	.064	-.111	.208	-.226	.370	-2.413	.153
32½	5.995	.132	.611	.057	8.323	.106	11.948	-.044	6.513	.059	-.016	.207	-.127	.369	-2.773	.159
33	6.245	.130	.347	.062	8.641	.104	12.683	-.052	6.612	.060	.133	.205	-.286	.363	-2.740	.158
33½	6.353	.131	.178	.065	9.125	.100	13.133	-.055	6.705	.060	.036	.207	-.415	.361	-2.905	.162
34	6.195	.135	.609	.059	9.377	.098	12.505	-.042	7.083	.056	.007	.206	-.514	.360	-3.500	.170
34½	6.402	.134	.717	.058	9.821	.095	12.396	-.037	7.412	.053	.039	.207	-.571	.359	-3.691	.173
35	6.687	.131	.593	.060	9.578	.100	12.619	-.038	7.500	.053	-.003	.208	-.731	.357	-3.190	.166
35½	7.136	.127	.741	.058	9.286	.107	12.998	-.040	7.665	.053	.010	.207	-.854	.355	-2.798	.160
36	7.684	.121	.722	.058	9.761	.103	13.635	-.047	7.723	.053	.001	.208	-.817	.356	-2.738	.159
36½	8.016	.117	.640	.060	10.553	.093	13.807	-.047	7.419	.059	-.617	.217	-.217	.365	-2.409	.154
37	7.537	.126	.252	.065	11.076	.089	13.707	-.042	7.254	.062	-.837	.221	-.227	.367	-2.049	.148
37½	7.088	.133	-.303	.074	10.514	.098	13.805	-.042	7.355	.062	-.549	.217	-.350	.365	-2.374	.152
38	8.040	.120	.312	.065	10.756	.097	14.227	-.045	7.854	.057	-.707	.220	-.121	.352	-2.393	.152
38½	8.594	.114	.769	.059	10.695	.099	14.318	-.043	7.947	.056	-.742	.220	-.120	.355	-2.232	.148
39	7.839	.126	-.323	.074	10.738	.101	14.265	-.041	7.362	.066	-.407	.215	-.361	.365	-3.301	.164

Hip girth (inches)	Waist to hips (inches)		Thigh girth (inches)		Maximum calf girth (inches)		Knee girth (inches)		Total crotch length (inches)		Anterior crotch length (inches)		Extreme bend (inches)		Vertical trunk girth (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	0.517	0.111	12.481	-0.030	7.053	0.021	6.256	0.056	9.655	0.178	5.292	0.080	4.362	0.304	19.746	0.416
20½	-.741	.143	12.869	-.034	7.155	.022	5.940	.067	8.192	.220	4.634	.099	3.382	.326	18.322	.452
21	.983	.101	12.506	-.017	7.355	.022	6.605	.053	10.433	.167	5.846	.075	4.928	.295	20.761	.402
21½	1.519	.089	13.978	-.045	7.549	.021	6.958	.048	12.132	.131	6.161	.070	4.601	.304	21.201	.398
22	1.101	.099	13.692	-.030	7.705	.021	6.839	.054	11.963	.142	5.578	.082	4.110	.319	21.191	.406
22½	1.255	.096	14.717	-.046	7.727	.024	6.861	.056	11.354	.159	5.171	.092	3.382	.337	20.555	.427
23	1.248	.096	15.553	-.057	7.991	.022	7.117	.054	11.181	.168	4.617	.107	3.021	.348	20.541	.434
23½	1.187	.098	15.268	-.044	8.139	.022	7.107	.057	11.254	.170	4.646	.108	2.797	.354	20.949	.431
24	1.594	.089	15.488	-.041	8.385	.020	7.082	.061	12.437	.150	5.562	.091	3.198	.348	21.625	.422
24½	1.812	.085	16.944	-.064	8.744	.016	7.129	.062	13.016	.142	5.868	.086	3.403	.346	22.810	.405
25	1.850	.085	17.046	-.059	8.883	.019	7.359	.061	13.002	.147	5.862	.088	3.390	.348	23.507	.397
25½	1.912	.084	17.578	-.062	8.948	.019	7.575	.059	12.943	.152	5.829	.091	3.318	.351	23.677	.400
26	2.079	.082	17.742	-.058	9.077	.020	7.685	.060	13.160	.153	5.948	.091	3.274	.355	23.717	.405
26½	2.264	.078	17.759	-.051	9.112	.022	7.605	.064	13.308	.154	5.811	.095	3.234	.357	23.267	.420
27	2.206	.080	18.929	-.066	9.318	.021	7.938	.060	13.399	.158	5.440	.104	3.071	.363	23.003	.431
27½	1.866	.087	18.966	-.060	9.374	.023	8.102	.060	13.096	.166	5.385	.107	3.003	.365	22.393	.447
28	1.893	.086	20.239	-.076	9.485	.025	8.001	.064	13.858	.157	5.417	.108	2.204	.381	22.838	.446
28½	2.358	.079	21.520	-.092	9.890	.021	8.389	.060	14.513	.149	5.460	.109	4.199	.347	22.677	.454
29	2.664	.074	22.173	-.096	10.237	.017	8.607	.059	13.836	.166	5.440	.111	4.632	.342	21.572	.479
29½	2.558	.076	22.830	-.101	10.100	.022	8.530	.063	13.239	.180	5.591	.111	4.852	.340	21.417	.488
30	2.326	.080	22.361	-.086	9.898	.029	8.681	.063	13.235	.185	5.473	.116	4.762	.343	21.051	.500
30½	2.418	.079	22.411	-.115	10.119	.028	9.023	.060	12.503	.201	4.597	.133	5.078	.339	19.630	.531
31	2.626	.076	22.268	-.073	10.236	.029	9.420	.055	12.044	.214	4.299	.140	5.675	.331	17.443	.573
31½	2.636	.077	25.887	-.127	10.286	.031	9.940	.049	12.547	.210	4.618	.137	5.582	.334	17.347	.582
32	2.700	.077	26.852	-.136	10.749	.026	10.481	.042	13.098	.205	4.717	.137	6.000	.329	14.234	.638
32½	2.472	.081	27.982	-.148	11.163	.022	11.133	.033	12.793	.214	4.591	.141	6.178	.327	14.058	.647
33	2.489	.082	28.081	-.144	11.763	.015	11.910	.023	12.916	.216	4.852	.138	6.270	.327	17.158	.605
33½	2.511	.081	29.162	-.155	12.190	.011	12.746	.012	13.679	.208	5.484	.130	7.064	.316	16.581	.621
34	2.250	.086	28.810	-.143	12.515	.009	13.230	.006	14.291	.201	6.199	.121	7.279	.314	16.662	.625
34½	2.159	.087	29.150	-.144	12.907	.005	13.334	.006	15.332	.189	6.772	.113	7.294	.315	18.308	.606
35	2.099	.089	28.881	-.130	13.168	.004	13.479	.006	16.212	.179	7.016	.111	7.448	.315	19.323	.595
35½	1.946	.092	29.043	-.130	13.355	.004	13.430	.009	16.577	.177	7.039	.112	7.324	.318	20.878	.578
36	2.056	.090	29.385	-.128	13.731	.001	13.712	.007	16.538	.180	6.917	.115	6.961	.325	22.344	.561
36½	2.214	.088	30.708	-.142	13.768	.003	13.748	.008	16.857	.179	6.779	.118	7.006	.325	23.563	.549
37	2.110	.090	30.587	-.135	12.999	.017	13.514	.0								

TABLE 68.—Regression coefficients *a* and *b* (for girls) for use in calculating the values for any one of the 32 measurements for specified hip values in combination with any height values

Hip girth (inches)	Waist height (inches)		Hip height (inches)		Weight (pounds)		Cervicale height (inches)		Tibiale height (inches)		Birochanteric diameter (inches)		Shoulder slope (degrees)		Anterior chest width (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	-4.053	0.697	-5.050	0.599	-4.634	0.910	-1.643	0.861	-1.689	0.303	4.869	0.057	31.420	-0.169	4.254	0.082
20½	-4.264	.708	-4.430	.587	-1.588	.856	-2.527	.885	-2.052	.313	5.597	.042	31.079	-.135	3.873	.091
21	-5.005	.725	-5.519	.615	-1.449	.874	-2.881	.894	-2.605	.327	5.579	.045	27.160	-.051	4.516	.077
21½	-5.217	.730	-6.502	.637	.610	.852	-3.230	.901	-2.125	.315	5.894	.041	26.972	-.039	5.214	.062
22	-4.917	.723	-6.240	.631	1.341	.861	-2.641	.887	-1.963	.311	5.946	.043	28.246	-.068	5.333	.061
22½	-4.589	.715	-6.151	.627	.782	.903	-2.308	.881	-2.551	.324	5.802	.049	29.139	-.085	5.207	.065
23	-4.572	.715	-6.196	.628	.812	.928	-1.839	.870	-2.418	.322	6.224	.042	28.875	-.078	5.019	.072
23½	-4.739	.719	-6.265	.630	2.128	.927	-1.773	.870	-2.084	.315	6.619	.036	28.523	-.067	5.004	.074
24	-4.860	.722	-6.431	.633	3.181	.935	-2.198	.879	-1.974	.313	6.859	.034	29.038	-.074	5.012	.076
24½	-4.648	.718	-6.351	.631	3.212	.965	-2.299	.882	-2.071	.315	6.933	.036	30.502	-.107	4.894	.080
25	-5.064	.727	-6.579	.636	4.836	.963	-2.496	.886	-2.350	.322	7.084	.035	32.785	-.150	4.917	.082
25½	-5.424	.735	-6.927	.643	6.375	.965	-2.841	.894	-2.350	.322	7.188	.036	33.082	-.153	4.996	.081
26	-5.284	.732	-6.965	.643	7.369	.980	-3.149	.900	-2.301	.321	7.174	.039	31.109	-.112	5.278	.078
26½	-4.973	.726	-6.571	.635	5.814	1.044	-3.304	.904	-2.321	.322	7.177	.042	31.447	-.119	5.439	.076
27	-4.368	.715	-5.971	.623	6.532	1.063	-3.434	.906	-2.090	.317	7.296	.042	31.129	-.111	5.568	.075
27½	-3.995	.708	-5.790	.620	10.572	1.020	-3.487	.908	-2.071	.317	7.506	.041	29.759	-.086	5.848	.072
28	-4.131	.711	-5.844	.621	14.585	.984	-3.620	.911	-2.063	.318	7.626	.041	29.473	-.080	6.058	.069
28½	-3.747	.705	-5.570	.616	14.517	1.021	-3.972	.917	-2.045	.317	7.592	.045	29.522	-.079	6.369	.065
29	-2.836	.689	-5.010	.605	15.816	1.035	-3.879	.916	-1.853	.314	7.657	.046	28.929	-.070	6.465	.065
29½	-2.351	.680	-4.575	.597	18.516	1.026	-3.563	.911	-1.559	.308	7.603	.050	28.464	-.061	6.524	.066
30	-2.002	.675	-4.286	.591	22.084	.999	-3.438	.909	-1.255	.303	7.481	.055	28.541	-.061	6.852	.061
30½	-1.365	.663	-3.781	.584	24.992	.989	-3.304	.907	-.989	.298	7.479	.057	27.788	-.050	6.840	.063
31	-.805	.653	-3.224	.572	28.012	.975	-3.223	.906	-.747	.293	7.399	.061	26.900	-.031	6.707	.067
31½	-.310	.645	-2.852	.565	33.918	.914	-3.248	.906	-.289	.285	7.350	.065	24.992	.005	6.908	.065
32	.809	.626	-2.049	.550	38.689	.875	-3.056	.904	.130	.278	7.597	.063	22.522	.043	7.347	.070
32½	1.582	.613	-1.835	.546	41.876	.866	-2.696	.898	.273	.275	7.925	.060	21.593	.058	7.427	.060
33	1.652	.612	-2.266	.552	44.114	.867	-2.214	.890	.061	.278	8.416	.054	21.763	.053	7.099	.067
33½	.900	.624	-2.725	.559	44.565	.903	-2.164	.888	-.462	.286	8.513	.055	22.131	.044	6.892	.072
34	.776	.625	-2.857	.559	43.802	.956	-2.385	.893	-.257	.282	8.749	.054	21.885	.048	7.293	.078
34½	.696	.626	-2.998	.561	43.902	.996	-2.368	.893	-.198	.280	9.182	.049	19.927	.078	7.749	.061
35	-.136	.639	-3.570	.569	42.718	1.059	-2.236	.891	-.674	.288	9.479	.047	18.127	.105	7.746	.063
35½	-.037	.637	-3.133	.562	42.569	1.105	-1.964	.886	-.641	.287	9.970	.041	17.912	.108	7.330	.071
36	-.096	.638	-3.255	.563	43.395	1.135	-2.018	.887	-.832	.290	10.434	.036	15.903	.136	7.369	.071
36½	-.400	.643	-4.191	.577	44.560	1.165	-1.972	.887	-1.081	.294	10.795	.033	15.747	.137	7.617	.069
37	-.296	.642	-4.653	.585	49.251	1.142	-2.041	.888	-1.131	.295	10.673	.037	18.813	.083	8.153	.062
37½	-.693	.649	-5.013	.590	52.685	1.136	-2.082	.889	-1.245	.297	10.656	.040	18.945	.087	8.214	.062
38	-.733	.662	-5.682	.600	51.160	1.203	-1.613	.882	-1.564	.301	10.907	.038	15.915	.137	8.934	.052
38½	-.916	.653	-4.246	.577	52.612	1.230	-1.149	.876	-1.425	.299	11.341	.034	14.305	.156	8.933	.053
39	-1.133	.657	-4.552	.582	55.096	1.246	-1.928	.888	-1.091	.295	11.941	.027	15.507	.138	7.643	.073

Hip girth (inches)	Anterior waist length (inches)		Posterior chest width (inches)		Posterior waist length (inches)		Chest girth at armseye (inches)		Seye depth (inches)		Posterior hip arc (inches)		Anterior chest arc (inches)		Waist girth (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	3.414	0.128	4.217	0.115	2.127	0.176	14.997	0.142	1.409	0.074	7.365	0.063	8.759	0.049	20.792	-0.055
20½	3.408	.125	4.695	.105	2.856	.158	16.760	.102	1.727	.069	8.140	.051	9.079	.044	21.542	-.070
21	3.731	.119	4.983	.100	2.592	.165	17.187	.099	1.959	.063	9.197	.028	8.957	.050	21.848	-.071
21½	4.040	.112	5.360	.093	2.763	.161	17.400	.101	1.867	.065	10.026	.014	8.931	.055	21.648	-.057
22	3.863	.117	5.238	.097	3.031	.155	17.925	.093	1.699	.070	10.792	.003	8.994	.056	21.763	-.053
22½	3.306	.131	4.859	.106	2.639	.165	18.152	.094	1.658	.071	11.262	-.002	9.149	.056	22.075	-.054
23	3.417	.129	4.891	.105	2.708	.164	17.545	.113	1.951	.065	11.442	-.002	9.403	.054	22.282	-.053
23½	3.742	.123	4.908	.108	2.809	.162	17.556	.118	1.998	.065	12.010	-.008	9.708	.050	22.655	-.054
24	3.742	.124	5.264	.101	2.616	.166	18.326	.107	1.674	.072	12.654	-.016	9.793	.052	23.399	-.063
24½	3.545	.128	5.341	.100	2.434	.170	18.241	.114	1.818	.070	12.889	-.016	9.437	.063	23.298	-.056
25	4.063	.118	5.501	.098	2.595	.167	18.417	.116	2.140	.063	13.387	-.021	9.748	.060	23.394	-.051
25½	4.573	.108	5.768	.095	2.687	.165	18.881	.112	2.303	.061	13.952	-.027	10.269	.052	24.231	-.061
26	4.614	.109	5.730	.096	2.632	.167	19.325	.109	2.120	.065	14.225	-.027	10.663	.049	24.875	-.068
26½	4.243	.116	6.034	.092	2.396	.172	19.350	.114	2.230	.063	14.199	-.021	10.434	.056	24.716	-.059
27	3.903	.123	5.850	.096	1.739	.184	19.756	.111	2.418	.060	14.635	-.025	10.778	.053	25.205	-.062
27½	3.774	.126	5.909	.096	1.484	.190	20.546	.102	2.684	.056	15.316	-.032	11.548	.042	26.317	-.077
28	3.989	.122	6.160	.093	1.397	.192	21.392	.092	2.578	.059	15.705	-.034	12.068	.035	27.682	-.095
28½	3.955	.123	5.906	.098	.864	.201	21.420	.097	2.319	.064	15.758	-.030	12.542	.030	28.412	-.103
29	3.289	.136	5.995	.098	.397	.210	21.574	.100	2.584	.059	15.832	-.027	13.087	.023	29.356	-.114
29½	2.673	.147	6.347	.093	.066	.217	22.679	.086	2.801	.057	15.783	-.021	11.722	.051	30.939	-.136
30	2.644	.147	6.515	.091	-.221	.222	24.198	.066	2.453	.063	16.111	-.023	14.004	.014	32.301	-.154
30½	2.645	.149	6.697	.089	-.555	.228	24.946	.059	2.401	.065	16.560	-.026	13.953	.018	33.501	-.168
31	2.282	.155	7.019	.085	-.722	.232	25.326	.058	2.436	.065	16.510	-.020	14.124	.018	35.220	-.193
31½	2.193	.157	7.093	.085	-.823	.234	26.536	.044	1.924	.075	16.920	-.023	15.238	.003	37.009	-.218
32	2.018	.161	7.573	.078	-1.347	.244	27.996	.025	1.700	.079	17.921	-.035	16.034	-.007	38.428	-.237
32½	1.954	.162	7.789	.076	-1.670	.249	28.869	.017	2.099	.073	18.400	-.039	16.558	-.012	39.662	-.251
33	1.973	.163	8.043	.073	-1.024	.239	29.248	.017	2.027	.075	19.135	-.046	17.045	-.016	39.297	-.242
33½	1.955	.164	8.150	.073	-.196	.227	29.777	.015	1.714	.081	19.819	-.053	17.413	-.018	38.390	-.224
34	2.039	.164	8.088	.074	-.458	.231	30.721	.004	1.930	.078	19.358	-.041	17.817	-.021	38.409	-.220
34½	2.359	.160	8.587	.067	-.302	.229	31.854	-.009	1.975	.078	19.233	-.035	17.952	-.020	39.066	-.226
35	2.811	.153	9.298	.057	.541	.216	32.264	-.010	1.539	.086	19.911	-.041	17.800	-.015	38.014	-.206
35½	2.533	.158	9.579	.054	.820	.212	32.462	-.007	1.527	.087	20.316	-.044	18.239	-.018	36.418	-.176
36	2.952	.152	9.760	.052	1.090	.209	33.128	-.012	2.042	.079	20.428	-.041	18.884	-.025	37.105	-.182
36½	3.352	.146	9.671	.05												

TABLE 68.—Regression coefficients *a* and *b* (for girls) for use in calculating the values for any one of the 32 measurements for specified hip values in combination with any height values—Continued

Hip girth (inches)	Neck-base girth (inches)		Shoulder length (inches)		Armsye girth (inches)		Upper-arm girth (inches)		Elbow girth (inches)		Upper posterior arm length (inches)		Total posterior arm length (inches)		Trunk line (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	7.102	0.080	0.216	0.061	6.770	0.062	7.203	-0.033	5.770	0.018	-0.310	0.202	-0.539	0.355	-1.000	0.147
20½	7.348	.074	.436	.056	6.917	.064	7.234	-.030	5.770	.021	-.132	.192	-.226	.350	-.882	.098
21	7.938	.064	.712	.049	6.910	.064	7.688	-.039	5.256	.036	-.158	.201	-.129	.350	.699	.102
21½	7.973	.064	.879	.047	7.284	.058	8.188	-.047	5.271	.037	-.199	.202	-.027	.347	.502	.107
22	8.144	.062	.780	.049	7.775	.049	8.455	-.049	5.905	.025	-.313	.205	-.135	.344	.608	.105
22½	8.241	.061	.762	.050	7.598	.056	8.457	-.046	5.974	.025	-.533	.209	-.293	.354	.082	.117
23	8.147	.065	.647	.053	7.241	.067	8.532	-.045	6.045	.026	-.484	.208	-.554	.360	.003	.118
23½	8.452	.060	.606	.055	7.416	.066	8.822	-.048	5.882	.028	-.486	.209	-.675	.364	.424	.109
24	8.459	.061	.524	.057	7.634	.063	9.061	-.049	5.959	.031	-.517	.210	-.696	.365	.371	.109
24½	8.199	.068	.499	.057	7.647	.066	9.124	-.047	5.957	.034	-.540	.211	-.778	.367	-.069	.118
25	8.151	.070	.701	.054	7.004	.069	9.348	-.049	6.032	.034	-.585	.212	-.843	.370	-.027	.117
25½	8.213	.070	.827	.052	7.445	.075	9.482	-.048	6.075	.035	-.817	.217	-1.171	.377	.089	.114
26	8.352	.069	.877	.051	7.595	.075	9.613	-.047	6.198	.035	-1.070	.223	-1.645	.387	.105	.113
26½	8.304	.071	.871	.051	7.750	.074	9.611	-.046	6.085	.039	-.907	.220	-1.519	.385	-.028	.115
27	8.216	.074	.888	.051	7.808	.075	9.824	-.047	5.998	.043	-.712	.216	-1.107	.377	.413	.122
27½	8.398	.072	.994	.050	8.172	.071	10.549	-.056	6.182	.041	-.941	.221	-1.211	.380	-1.000	.133
28	8.631	.069	.909	.052	8.662	.064	11.248	-.065	6.350	.040	-.955	.221	-1.440	.385	-1.097	.135
28½	8.520	.072	1.025	.050	8.820	.064	11.480	-.066	6.525	.038	-.678	.216	-1.185	.380	-1.460	.141
29	8.423	.076	1.254	.046	9.002	.063	11.834	-.070	6.638	.038	-.534	.214	-.892	.376	-2.213	.153
29½	8.658	.072	1.186	.047	9.313	.060	12.407	-.077	6.540	.041	-.649	.216	-1.132	.381	-2.544	.159
30	8.881	.070	1.097	.049	9.895	.052	13.019	-.085	7.082	.033	-.656	.217	-1.148	.381	-2.670	.160
30½	8.739	.074	1.098	.049	10.061	.052	13.501	-.091	7.365	.029	-.553	.215	-.790	.375	-2.891	.164
31	8.536	.078	1.110	.049	9.919	.056	13.852	-.094	7.561	.028	-.634	.216	-.711	.373	-3.057	.167
31½	8.856	.075	1.168	.049	10.385	.051	14.460	-.101	7.811	.025	-.831	.220	-.760	.375	-3.113	.167
32	8.876	.076	1.319	.046	10.843	.045	14.934	-.106	8.183	.020	-.587	.216	-.208	.366	-3.274	.170
32½	8.955	.076	1.310	.047	11.339	.039	15.031	-.105	8.507	.016	-.389	.213	-.312	.358	-3.564	.174
33	9.000	.076	1.305	.047	11.464	.040	14.884	-.100	8.837	.012	-.260	.211	-.777	.351	-3.271	.170
33½	9.131	.076	1.260	.048	11.729	.038	14.840	-.096	9.015	.010	-.047	.208	-.893	.349	-2.920	.165
34	9.449	.071	1.412	.046	12.456	.027	15.017	-.096	9.012	.011	.101	.206	-.867	.350	-3.294	.171
34½	9.796	.067	1.634	.042	12.583	.028	15.003	-.093	8.988	.012	-.035	.208	-.892	.349	-3.125	.168
35	9.973	.066	1.767	.040	12.090	.038	14.853	-.088	9.187	.010	-.053	.209	-.828	.351	-2.084	.151
35½	9.779	.071	1.857	.039	11.926	.043	14.832	-.085	9.085	.013	.154	.206	1.267	.344	-2.156	.152
36	9.664	.073	1.722	.041	12.383	.037	14.872	-.083	9.185	.013	.143	.206	1.511	.341	-2.107	.151
36½	9.887	.071	1.758	.041	12.700	.034	15.109	-.084	9.398	.011	.064	.207	1.166	.346	-1.180	.136
37	10.329	.065	1.919	.039	12.600	.038	15.530	-.087	9.192	.016	-.274	.213	.621	.356	-1.043	.134
37½	11.105	.053	1.594	.044	13.230	.030	15.625	-.086	8.818	.023	-.521	.217	.175	.363	-1.288	.138
38	10.914	.058	1.736	.042	12.226	.032	15.208	-.077	8.484	.029	-.540	.217	.102	.364	-.067	.116
38½	10.346	.068	1.823	.041	12.285	.030	15.032	-.071	8.511	.030	-.473	.216	.834	.353	-.009	.117
39	9.767	.078	1.593	.044	11.891	.057	15.353	-.074	9.162	.021	.136	.207	.968	.351	-.647	.127

Hip girth (inches)	Waist to hips (inches)		Thigh girth (inches)		Maximum calf girth (inches)		Knee girth (inches)		Total crotch length (inches)		Anterior crotch length (inches)		Extreme bend (inches)		Vertical trunk girth (inches)	
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>
20	0.551	0.112	12.669	-0.032	6.814	0.028	6.603	0.043	8.487	0.207	4.703	0.093	2.683	0.352	15.961	0.496
20½	.352	.118	13.198	-.037	7.122	.024	6.958	.039	9.962	.179	6.182	.059	4.160	.320	20.405	.390
21	.521	.113	13.045	-.027	6.975	.031	6.411	.055	10.066	.176	5.750	.071	2.857	.351	20.994	.436
21½	.651	.110	13.911	-.039	7.247	.028	6.818	.048	9.630	.192	4.624	.099	2.020	.375	18.936	.436
22	1.130	.099	14.770	-.051	7.479	.026	6.967	.049	9.914	.189	4.550	.102	2.748	.360	19.121	.438
22½	1.547	.091	14.747	-.043	7.411	.031	6.696	.058	11.061	.167	5.051	.093	3.186	.352	19.679	.433
23	1.762	.086	15.122	-.044	7.745	.027	6.840	.058	11.092	.169	5.060	.094	2.687	.365	20.252	.424
23½	1.734	.087	16.095	-.058	8.000	.025	7.142	.054	10.957	.177	4.567	.106	2.679	.367	20.626	.422
24	1.777	.087	16.773	-.065	8.275	.022	7.256	.055	11.373	.172	4.513	.109	2.926	.364	20.582	.422
24½	1.711	.090	17.086	-.064	8.657	.018	7.432	.054	11.829	.168	4.732	.107	3.169	.361	20.222	.422
25	1.478	.095	17.834	-.071	8.921	.015	7.678	.052	11.998	.169	4.879	.105	3.241	.362	20.638	.438
25½	1.549	.094	18.309	-.074	9.190	.013	7.971	.049	12.167	.170	5.081	.103	3.370	.363	21.061	.436
26	1.803	.090	18.678	-.074	9.154	.017	8.166	.047	12.555	.167	5.071	.105	3.384	.364	21.292	.437
26½	1.765	.091	19.057	-.074	9.128	.021	8.153	.051	12.713	.168	5.245	.103	3.553	.363	20.502	.437
27	1.686	.093	19.596	-.077	9.543	.015	8.259	.051	13.125	.165	5.974	.091	4.208	.353	19.722	.478
27½	1.877	.090	20.813	-.093	9.893	.012	8.789	.047	14.058	.152	6.489	.083	4.882	.342	20.253	.474
28	1.978	.089	22.131	-.110	10.172	.009	9.127	.040	14.606	.145	6.577	.083	5.017	.347	20.861	.467
28½	1.836	.091	22.668	-.113	10.405	.008	9.170	.043	15.273	.138	7.120	.076	5.008	.344	20.242	.485
29	1.991	.091	23.208	-.116	10.787	.004	9.376	.041	16.429	.121	7.600	.069	5.600	.335	20.482	.486
29½	1.974	.091	24.210	-.127	11.052	.002	9.773	.037	16.973	.117	7.869	.067	6.153	.327	21.276	.477
30	2.310	.087	25.191	-.138	11.317	-.000	10.155	.032	17.364	.113	8.031	.065	6.185	.329	21.713	.474
30½	2.488	.084	25.683	-.140	11.660	-.003	10.706	.025	18.157	.104	8.476	.060	6.558	.324	21.663	.482
31	2.230	.089	26.219	-.143	11.845	-.004	11.144	.019	18.347	.105	8.627	.059	6.577	.325	21.496	.490
31½	2.047	.094	27.009	-.151	12.179	-.008	12.067	.006	18.854	.102	8.639	.061	6.107	.335	22.572	.477
32	2.153	.093	27.987	-.161	12.735	-.014	12.713	-.003	19.788	.089	9.408	.050	7.023	.322	23.348	.471
32½	2.501	.087	28.200	-.158	13.122	-.018	12.851	-.004	20.118	.088	9.717	.047	7.988	.308	23.607	.472
33	2.909	.082	27.976	-.149	13.306	-.019	13.229	-.008	20.256	.090	9.568	.051	7.539	.318	24.529	.463
33½	2.933	.082	27.948	-.143	13.538	-.020	13.230	-.007	20.621	.089	9.971	.047	6.629	.334	25.370	.456
34	3.002	.082	27.674	-.132	13.254	-.014	12.828	.002	20.374	.096	9.636	.054	6.883	.332	25.218	.464
34½	2.901	.084	27.455	-.122	13.067	-.008	12.767	.005	19.956	.107	9.378	.060	7.080	.330	25.757	.461
35	2.509	.091	27.326	-.114	13.075	-.006	12.731	.007	19.288	.122	9.198	.065	6.627	.339	26.789	.450
35½	2.358	.094	27.127	-.105	13.364	-.008	12.815	.008	19.251	.126	9.283	.066	6.658	.341	26.132	.465
36	2.667	.090	27.276	-.101	13.527	-.008	12.975	.007	19.670	.123	9.535	.064	7.216	.333	26.819	.459
36½	3.267	.081	27.228	-.095	13.622	-.007	13.078	.008	19.857	.124	9.113	.072	7.628	.328	28.8	

To determine from these tables the value of any one of the 32 measurements, the following general procedure should be used.

Suppose a value for hip girth and a height have been selected. It is desired to find for this combination of height and hip the corresponding value for one of the 32 measurements. To do this, locate the hip value in column 1 of table 67 or 68 (depending on whether the problem deals with boys or girls). Follow across to the two columns headed *a* and *b* under the measurement whose value is required. Multiply the selected height value by the entry given under column *b* and add to this algebraically the entry given in column *a*. The result is the desired value in inches.<sup>10</sup>

EXAMPLE 1.—It is desired to find the value of total posterior arm length for boys with hip girth 34 inches and height 65 inches. Locate the number 34 in column 1 of table 67. Then find the value for *b*, which is 0.360, under the heading total posterior arm length in the table. Multiply 0.360 by 65. This yields 23.400. Add to this the value of *a* or 0.514. The result is 23.914 inches. This is the value of total posterior arm length corresponding to hip girth 34 and height 65 for boys.

EXAMPLE 2.—It is desired to find the value of height of waist for girls with hip girth 28 inches and height 54 inches. Locate the 28 in column 1 of table 68. Then find the value for *b*, which is 0.711, under the heading "waist height" in the table. Multiply 0.711 by 54. This yields 38.394. Since *a* is preceded by a minus sign, subtract from this the number *a*, or 4.131. The result is 34.263 inches. This is the value of height of waist corresponding to hip girth 28 and height 54 inches for girls.

EXAMPLE 3.—It is desired to find the value of girth of upper arm for girls 25½ inches in hip girth and 48 inches in height. Locate the number 25½ in column 1 of table 68. Then find the value of *b*, or -0.048, and *a*, or 9.482, under the heading upper arm girth in the table. Multiply 0.048 by 48. This yields 2.304. Since the sign of *b* is minus, subtract this product (i. e. 2.304) from 9.482. This yields 7.178 inches. This is the value of girth of upper arm corresponding to hip girth 25½ inches and height 48 inches for girls.

The following list gives the average height for each of the specified hip girth values for boys.

Hip girth, inches	Average height, inches	Hip girth, inches	Average height, inches
20	40.415	30	58.763
20½	40.826	30½	59.409
21	41.793	31	60.199
21½	42.736	31½	61.045
22	43.819	32	61.822
22½	44.753	32½	62.844
23	45.747	33	63.584
23½	46.797	33½	64.327
24	47.854	34	65.342
24½	48.901	34½	66.093
25	49.935	35	66.540
25½	50.950	35½	67.202
26	52.000	36	67.576
26½	52.935	36½	67.948
27	53.962	37	68.237
27½	54.831	37½	68.441
28	55.587	38	68.594
28½	56.479	38½	69.120
29	57.221	39	68.930
29½	57.955		

<sup>10</sup> In these calculations the minus sign, which in some cases precedes the quantities *a* or *b*, must be taken into account. If *b* is preceded by a minus sign, then the product of the numerical value of *b* by the selected height must be subtracted from *a*. If *a* is preceded by a minus sign, then the numerical value of *a* should be subtracted from the product of *b* by the selected height. If neither *a* nor *b* is preceded by a minus sign, *a* is added to the product of *b* by the value of the selected height.

Below is a similar list giving the average height for each of the specified hip girth values for girls.

Hip girth, inches	Average height, inches	Hip girth, inches	Average height, inches
20	39.840	30	56.930
20½	40.826	30½	57.593
21	41.593	31	58.240
21½	42.357	31½	58.882
22	43.270	32	59.622
22½	44.204	32½	60.127
23	45.197	33	60.786
23½	46.156	33½	61.220
24	47.153	34	61.670
24½	48.023	34½	62.120
25	49.018	35	62.432
25½	50.000	35½	62.720
26	50.948	36	62.966
26½	51.724	36½	63.225
27	52.490	37	63.470
27½	53.333	37½	63.606
28	54.049	38	63.750
28½	54.852	38½	63.917
29	55.609	39	64.101
29½	56.316		

The average heights given in the above lists may be used in conjunction with tables 67 and 68 to obtain "regular" sizes.

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GIRTH OF HIPS (CENTIMETERS)



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STATURE (CENTIMETERS)

FIGURE 6.—Distribution of 69,661 boys 4 to 17 years of age on the basis of stature and girth of hips.

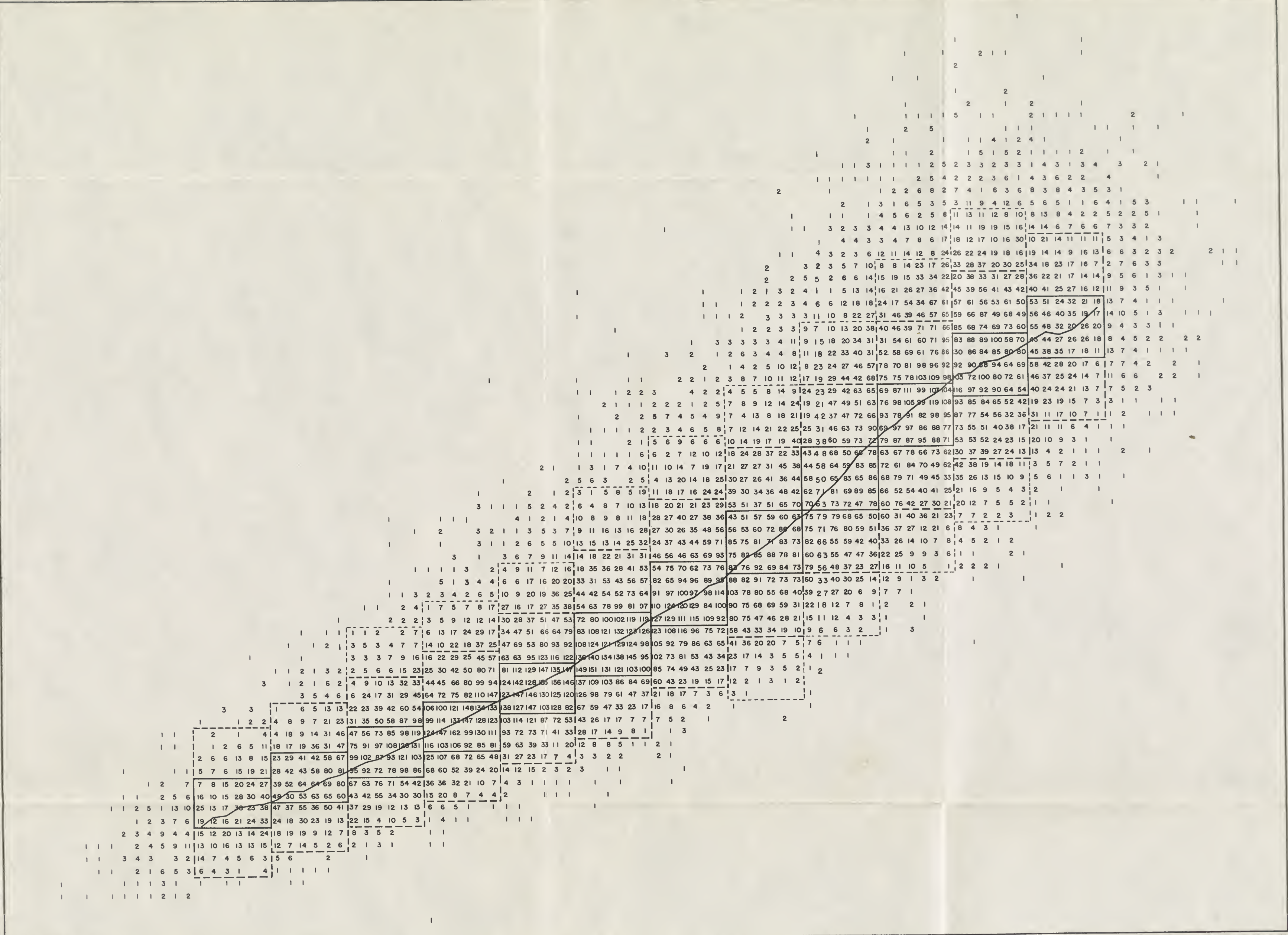
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GIRTH OF HIPS (CENTIMETERS)

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STATURE (CENTIMETERS)

FIGURE 7.—Distribution of 64,146 girls 4 to 17 years of age on the basis of stature and girth of hips.

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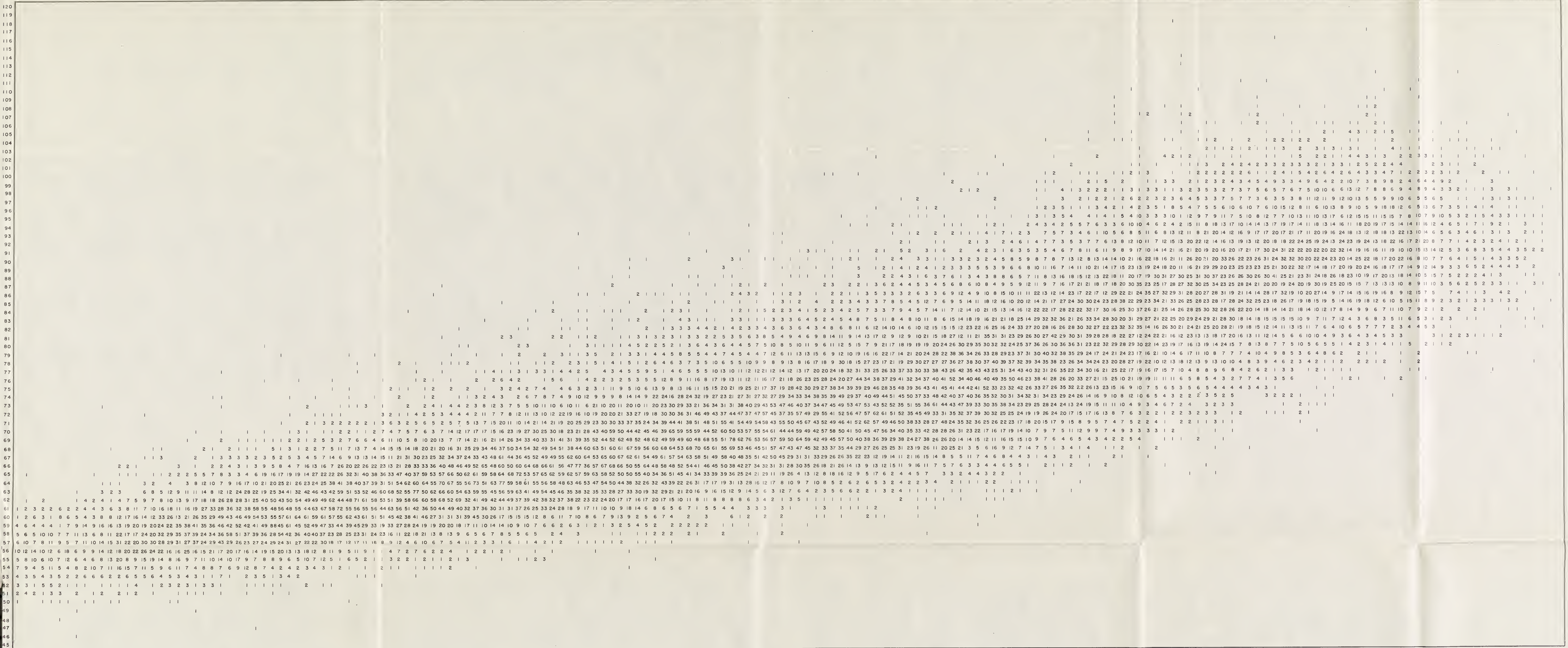








GIRTH OF CHEST SCYE (CENTIMETERS)



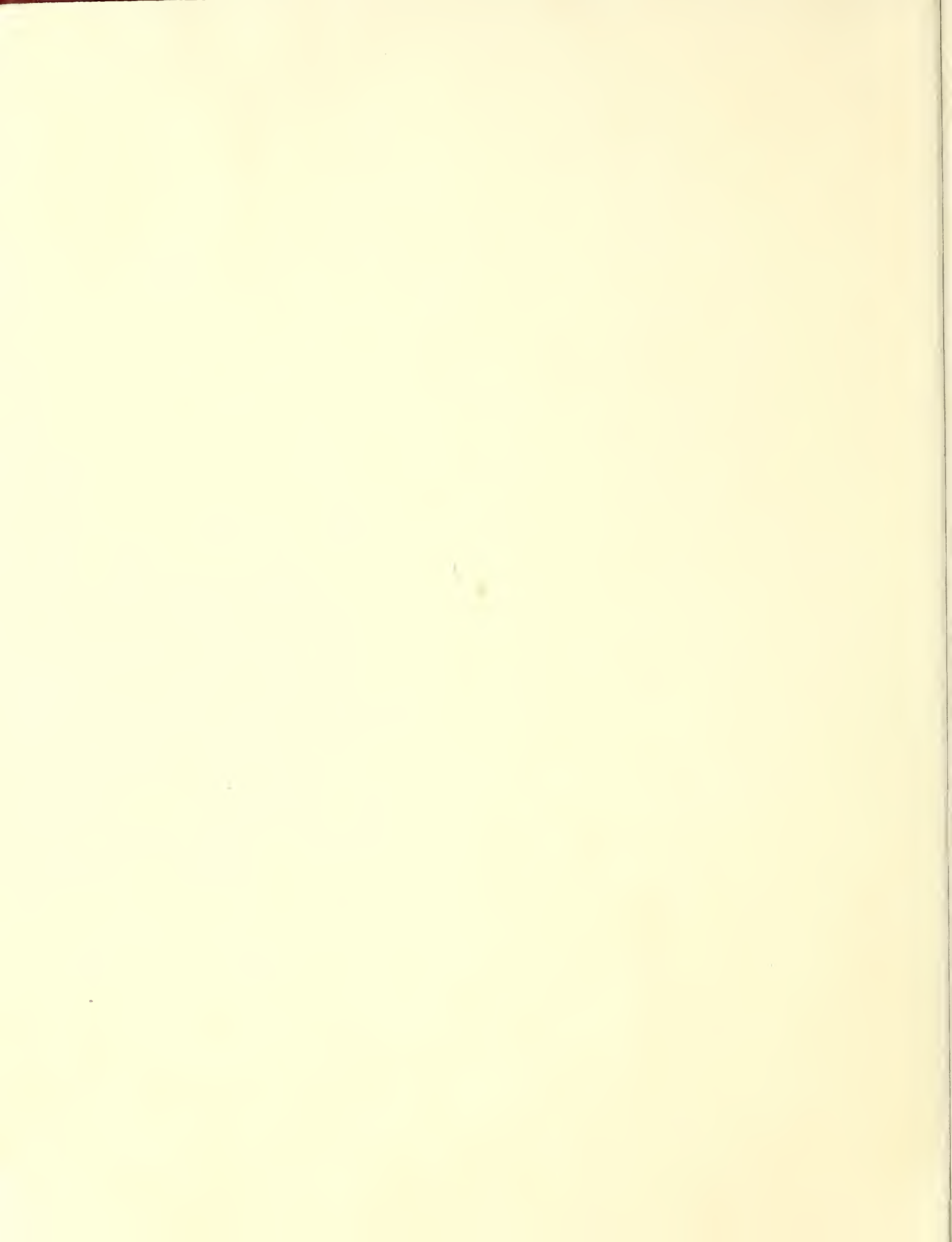
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AGE (MONTHS)

FIGURE 14.—Distribution of 69,661 boys 4 to 17 years of age on basis of age and chest girth.

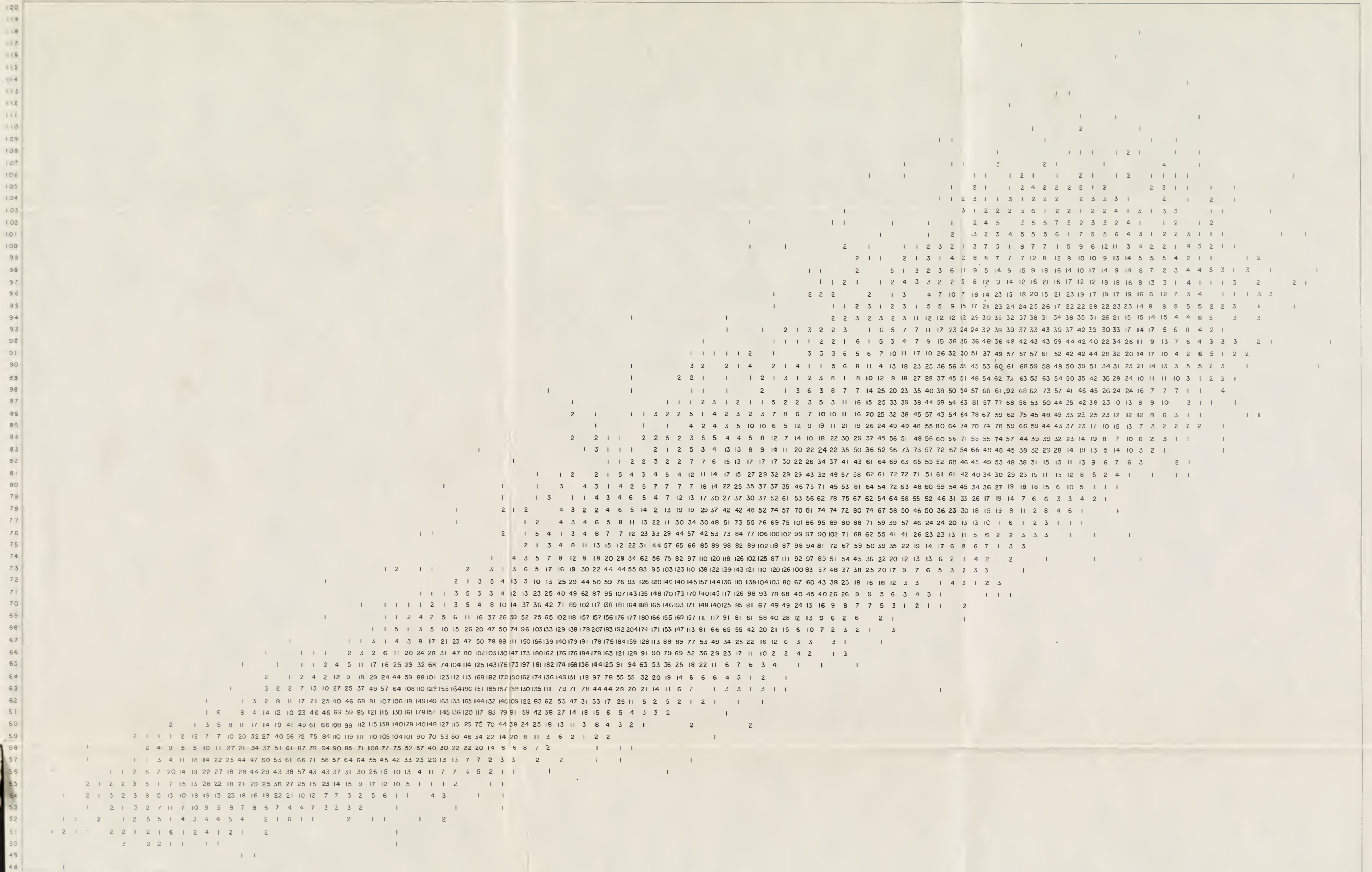






DISTRIBUTION OF STATURE AND GIRTH CHEST SCYE FOR BOYS 4 TO 17 YEARS OF AGE

GIRTH OF CHEST SCYE (CENTIMETERS)



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STATURE (CENTIMETERS)

FIGURE 15.—Distribution of 69,661 boys 4 to 17 years of age on basis of stature and chest girth.

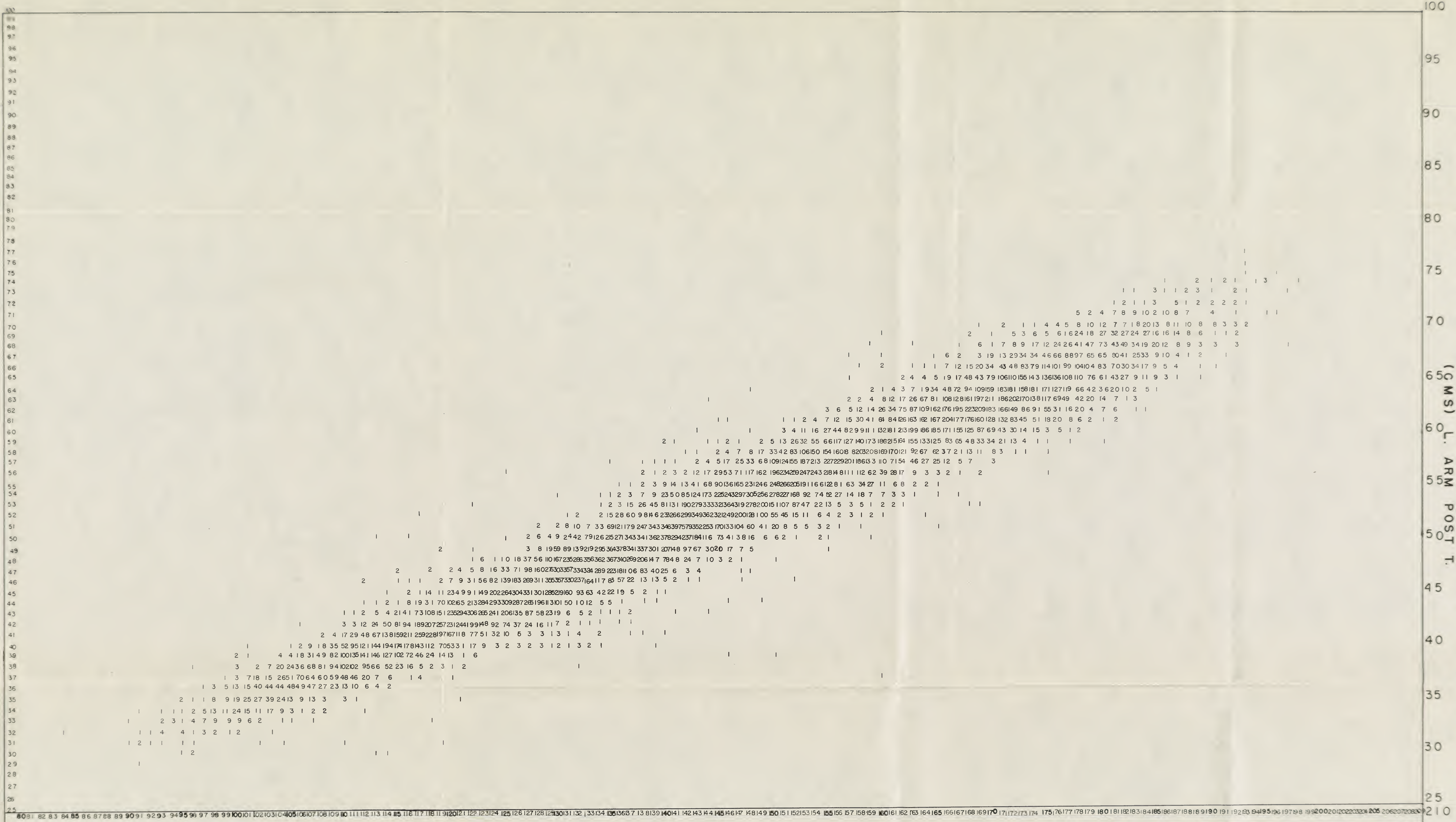








TOTAL POSTERIOR ARM LENGTH (CENTIMETERS)



STATURE (CENTIMETERS)

FIGURE 16.—Distribution of 69,661 boys 4 to 17 years of age on basis of stature and total posterior arm length.









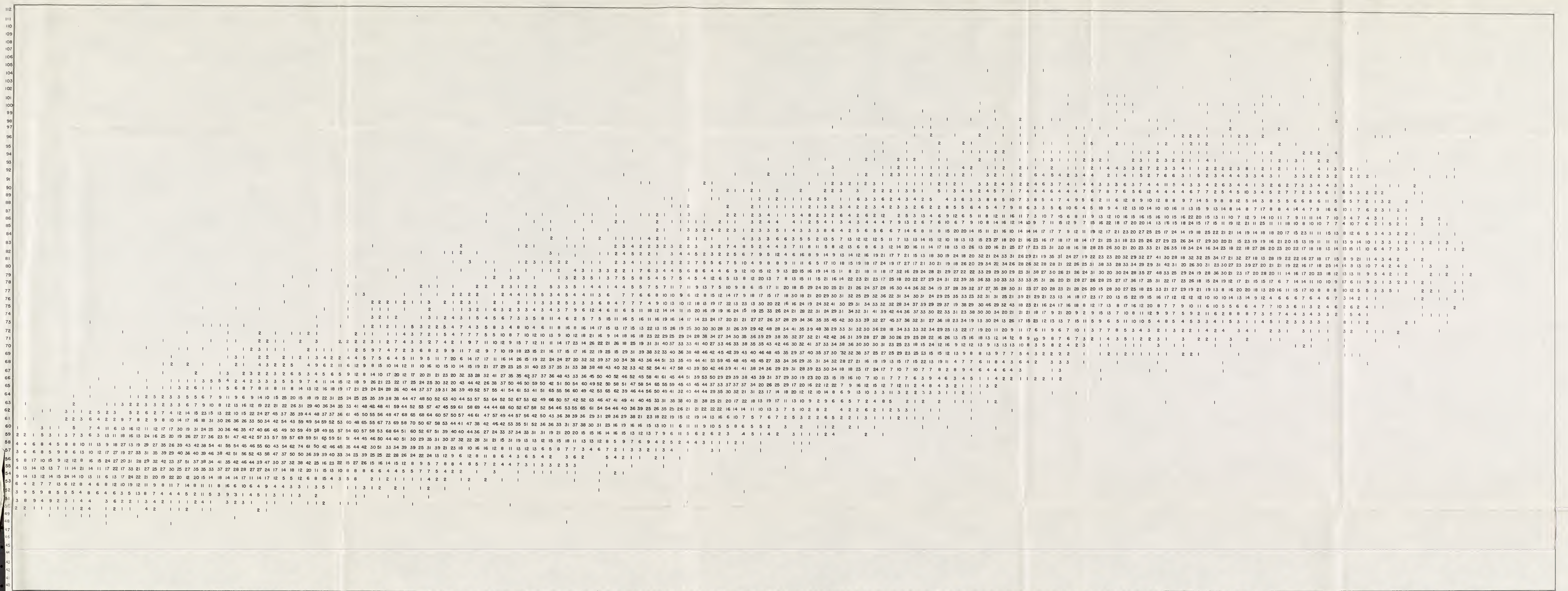








GIRTH OF CHEST SCYE (CENTIMETERS)

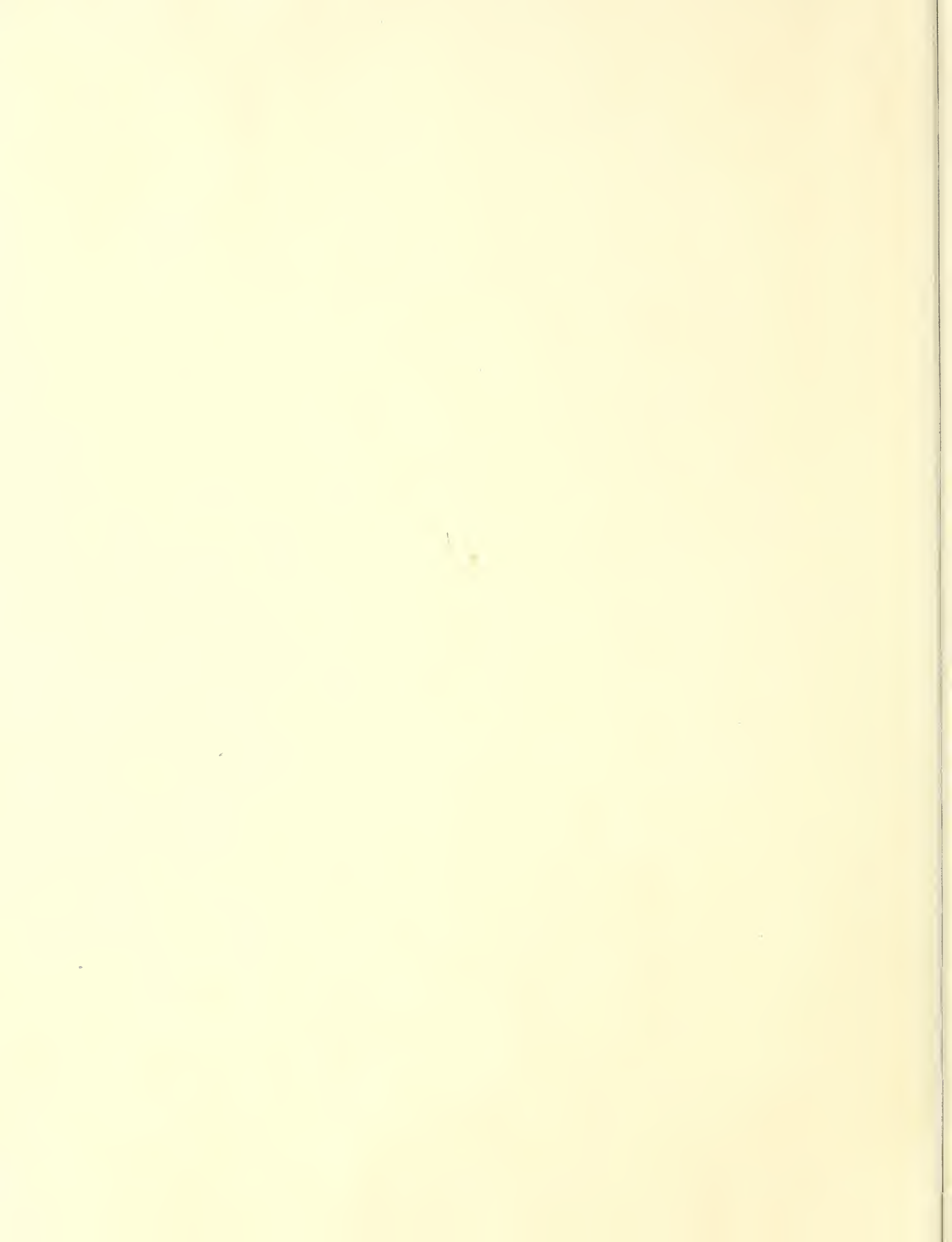


AGE (MONTHS)

FIGURE 18.—Distribution of 64,146 girls 4 to 17 years of age on basis of age and chest girth.

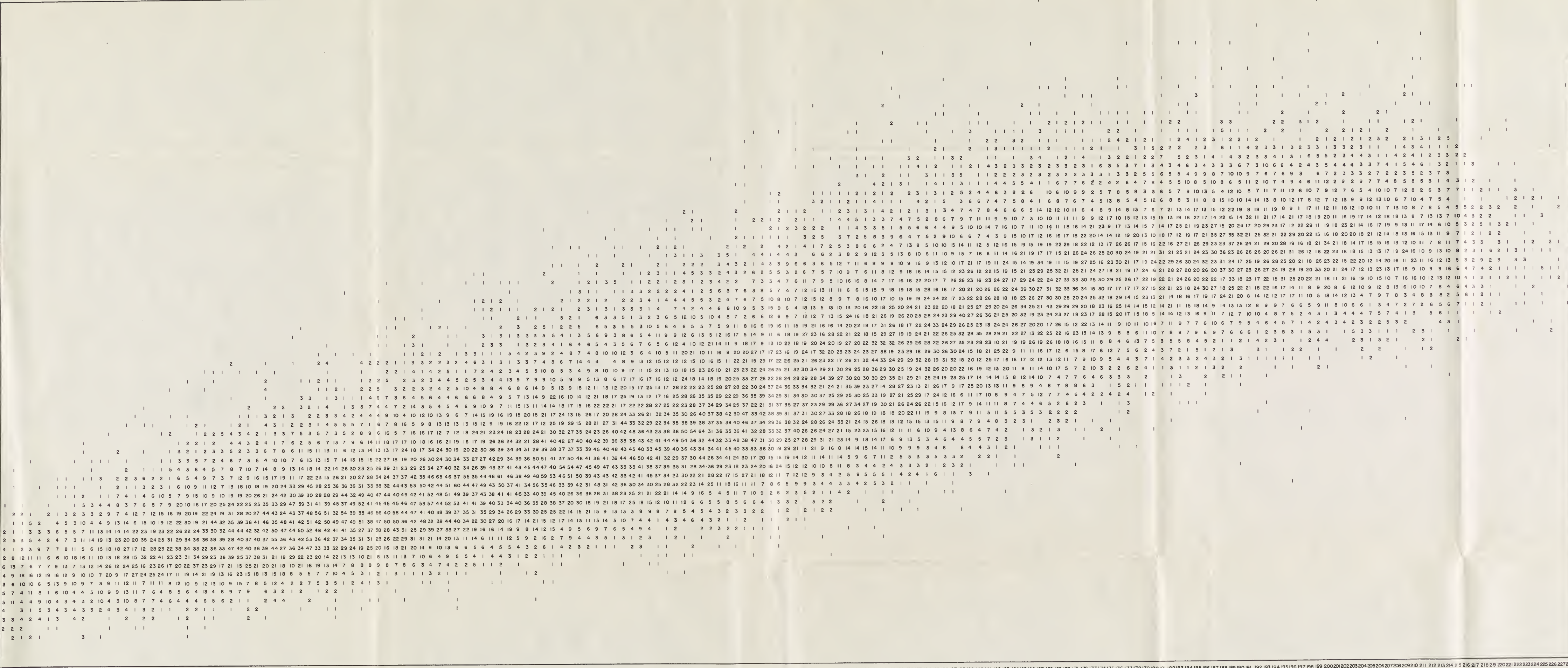






GIRTH OF HIPS (CENTIMETERS)

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AGE (MONTHS)

FIGURE 19.—Distribution of 64,146 girls 4 to 17 years of age on basis of age and hip girth.

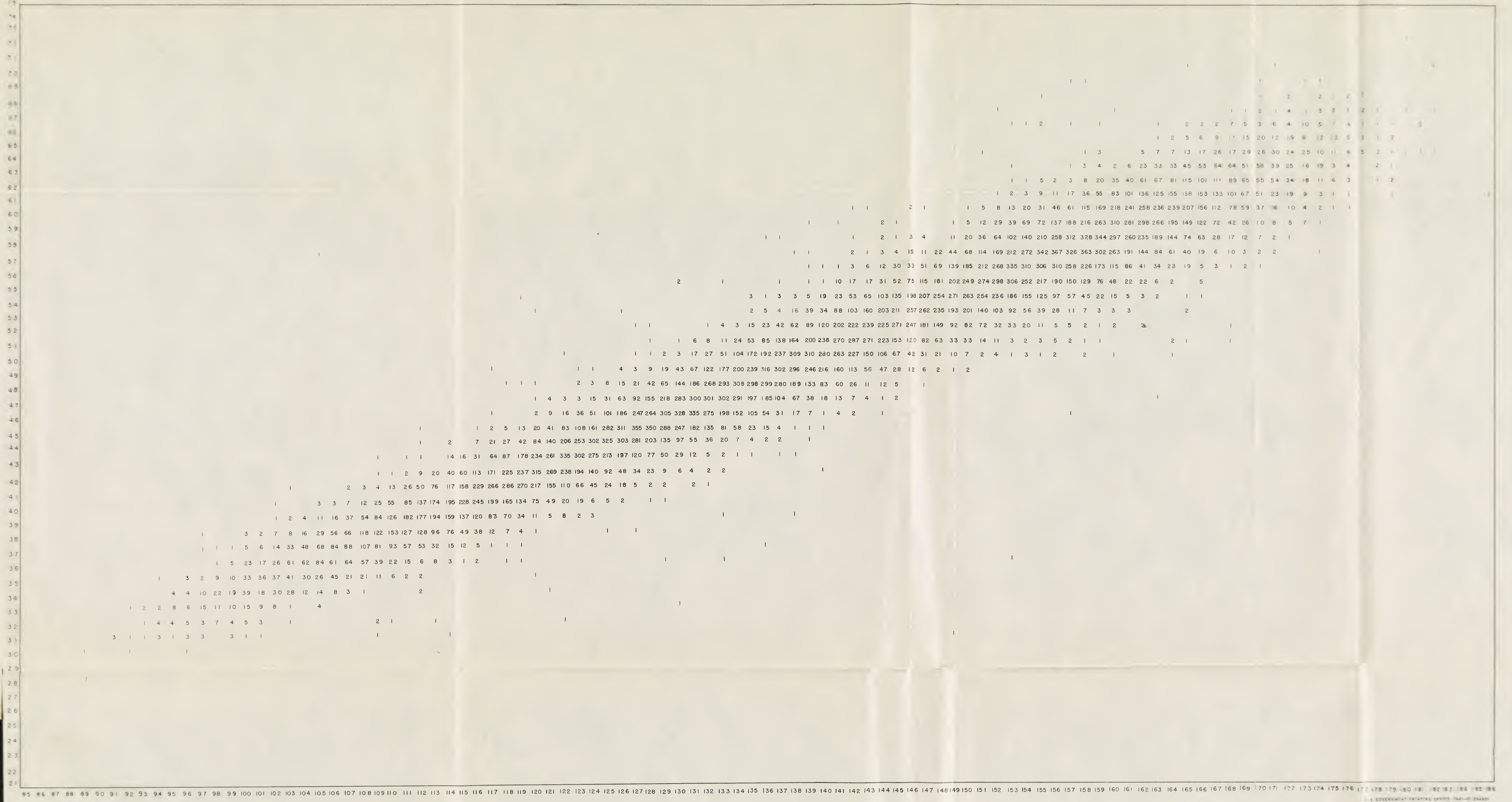








TOTAL POSTERIOR ARM LENGTH (CENTIMETERS)



STATURE (CENTIMETERS)

FIGURE 20.—Distribution of 64,146 girls 4 to 17 years of age on basis of stature and total posterior arm length.

1875

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STATURE (CENTIMETERS)

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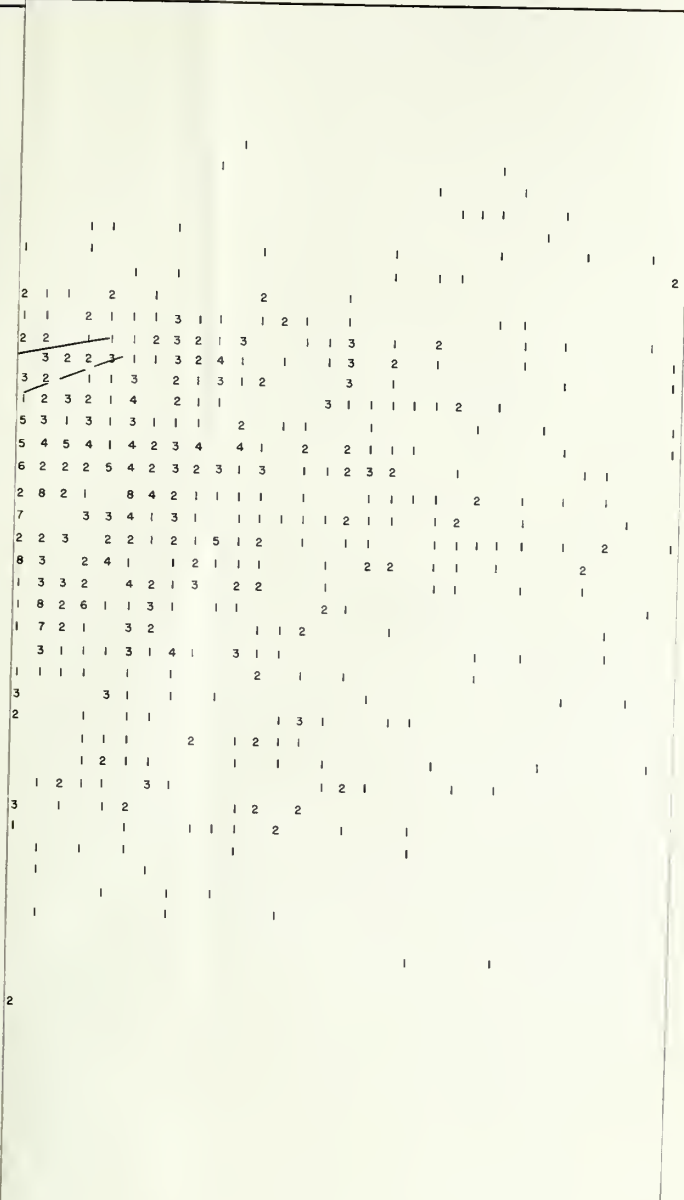
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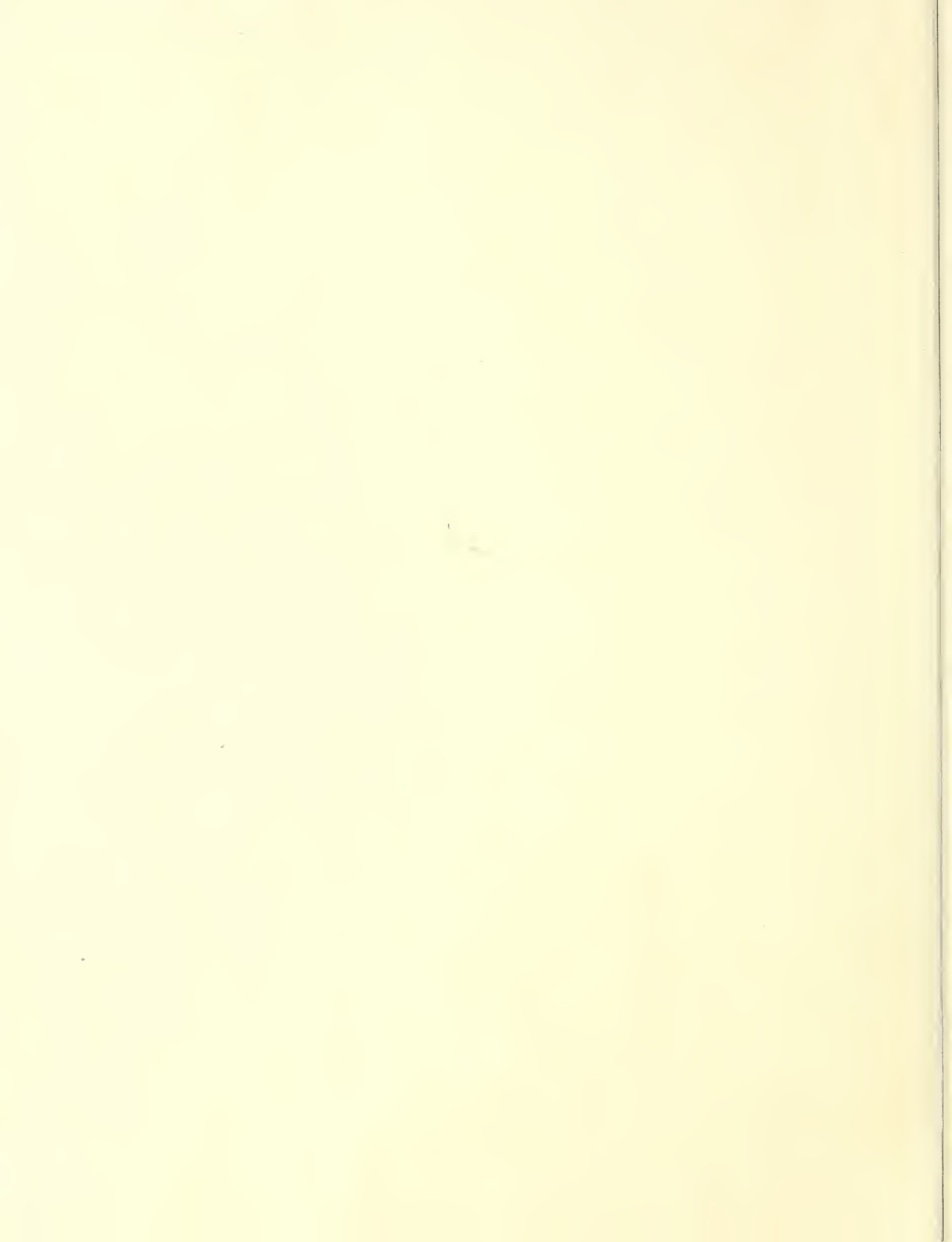
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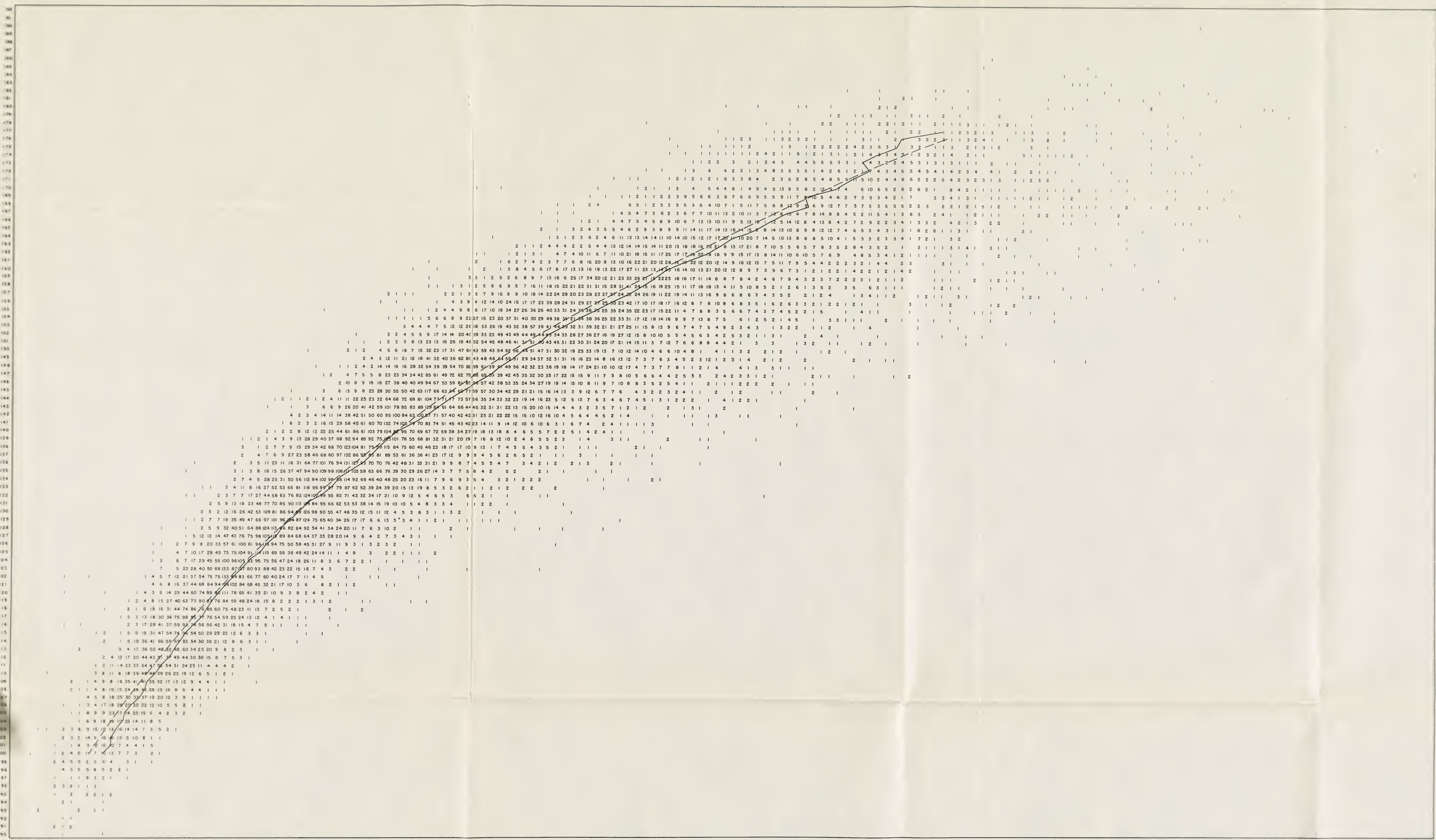
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STATURE (CENTIMETERS)

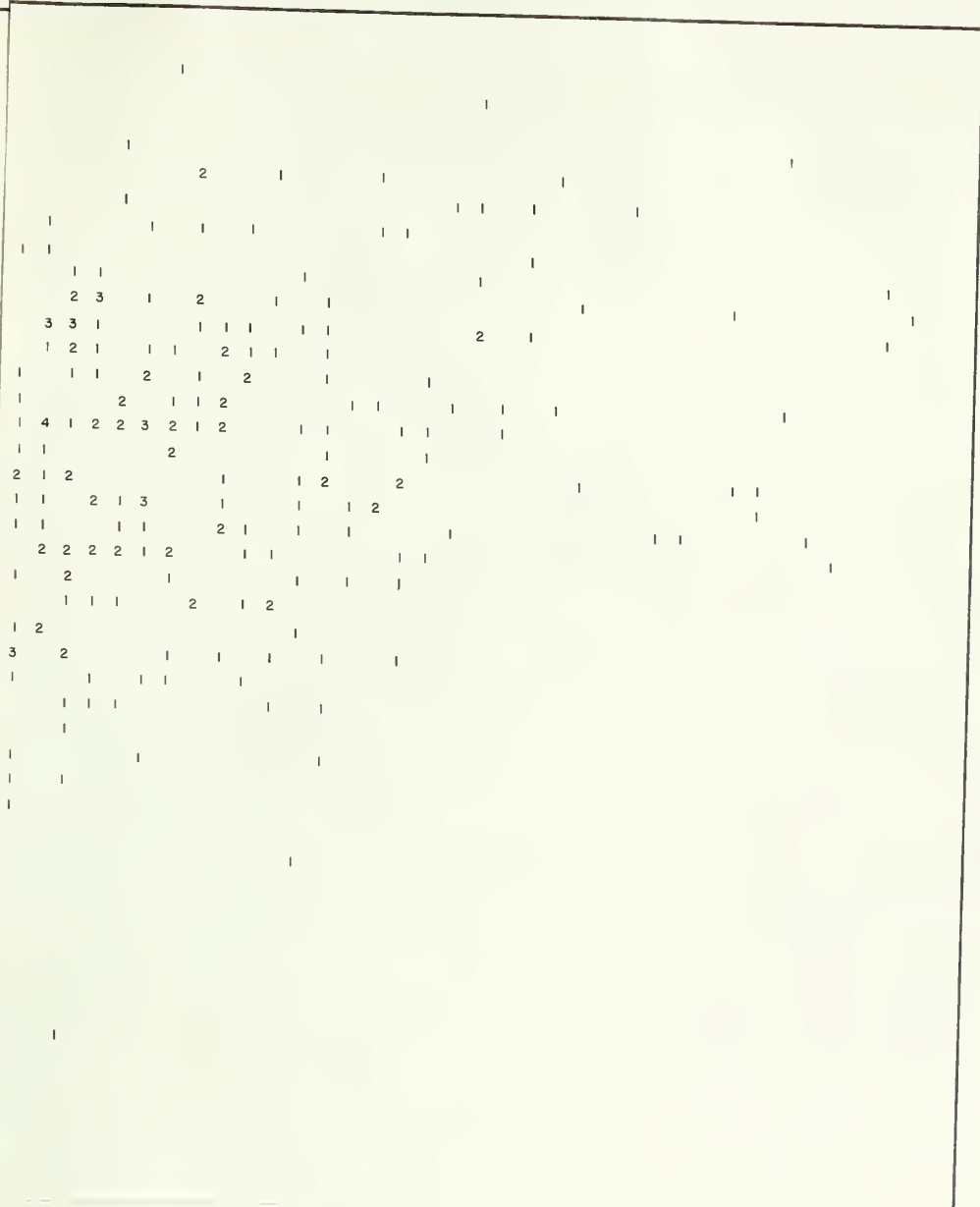


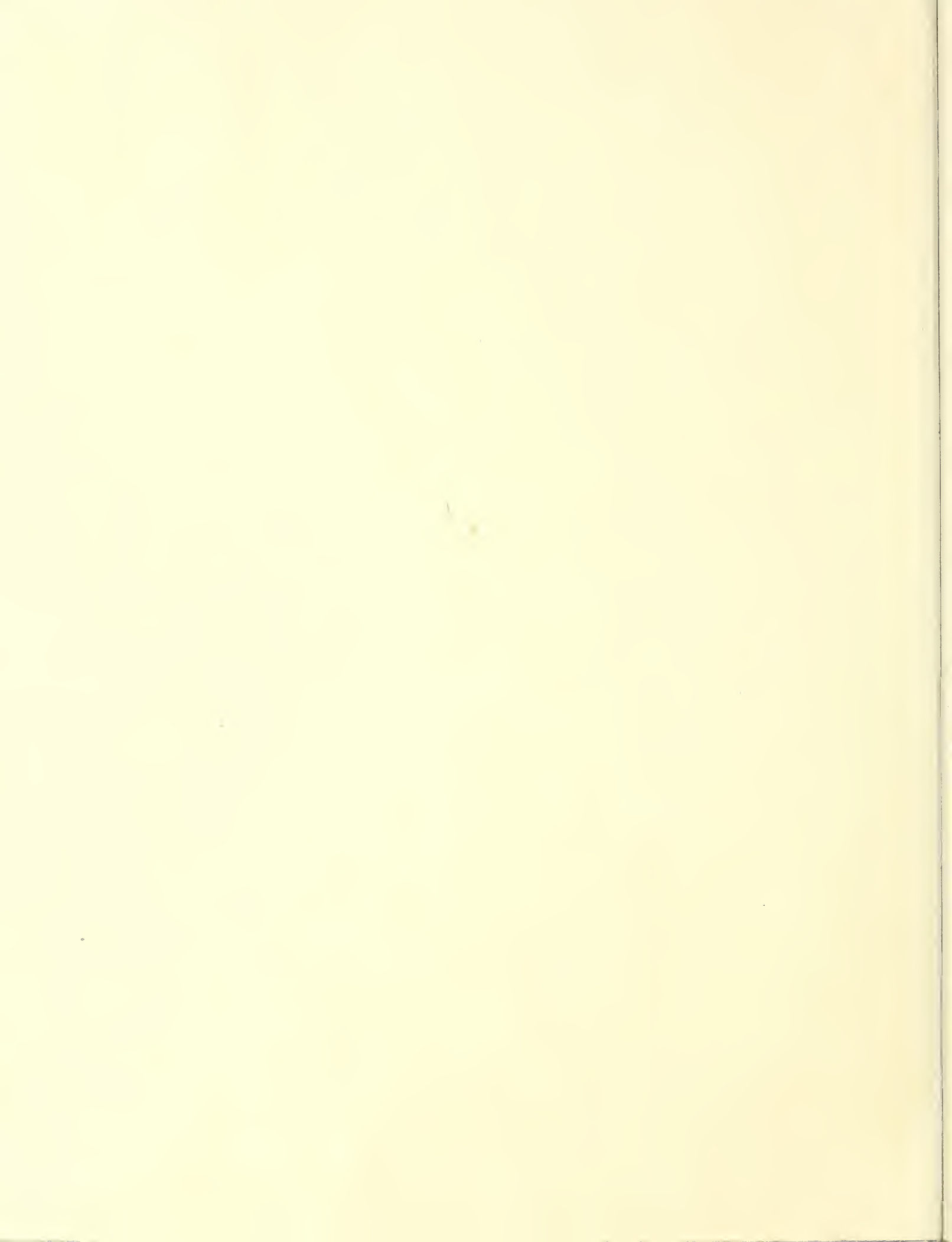
WEIGHT ( POUNDS )

FIGURE 55.—Distribution of 55,175 boys 4 to 14 years of age on basis of stature and weight. The solid curve in this figure was obtained by plotting the average weight for a centimeter unit of height. The broken curve was calculated by the method of least squares. (See page 70.)



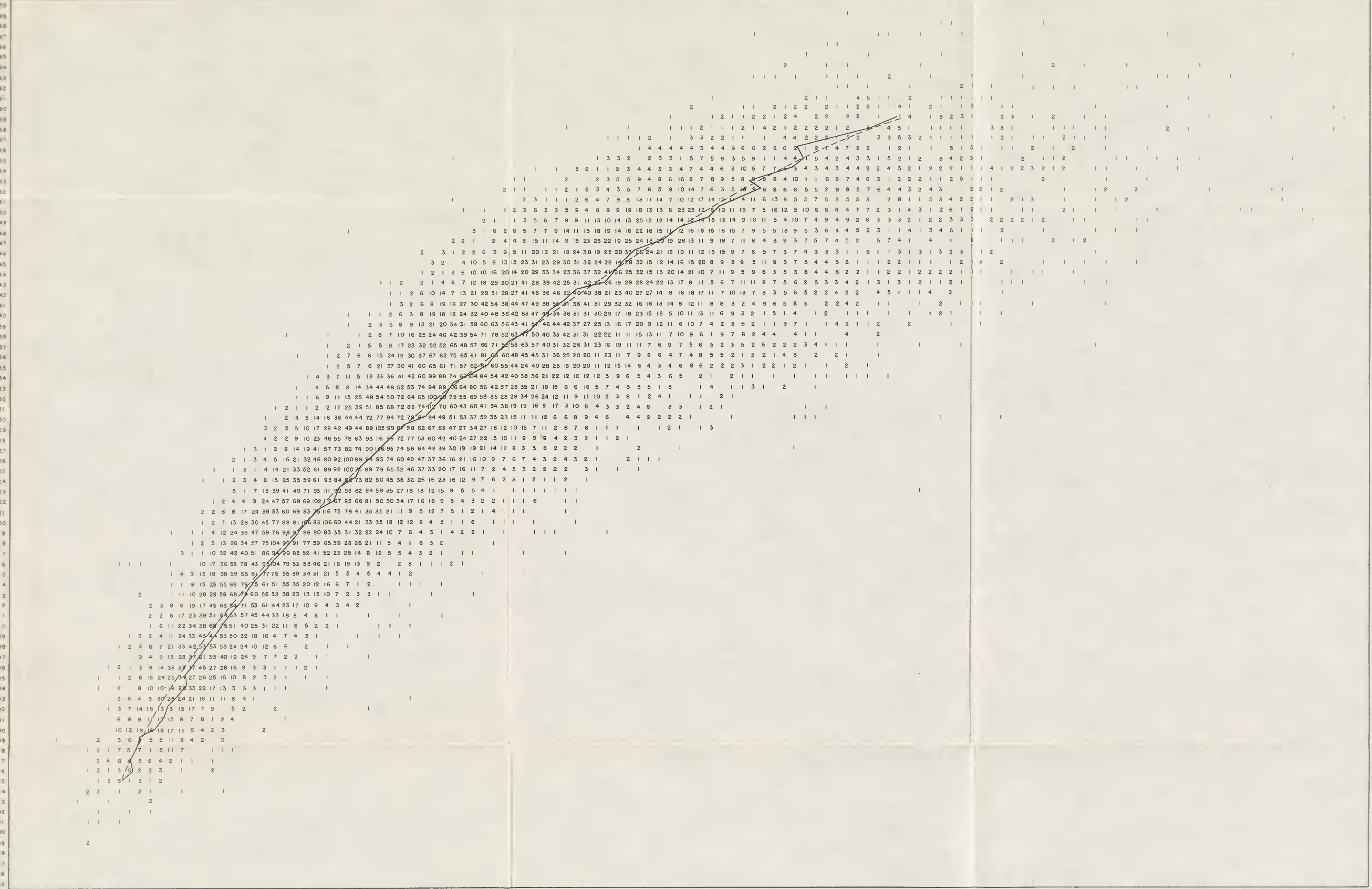
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STATURE (CENTIMETERS)

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WEIGHT (POUNDS)

FIGURE 56.—Distribution of 37,842 girls 4 to 11 years of age on basis of stature and weight. The solid curve in this figure was obtained by plotting the average weight for a centimeter unit of height. The broken curve was calculated by the method of least squares. (See page 70.)

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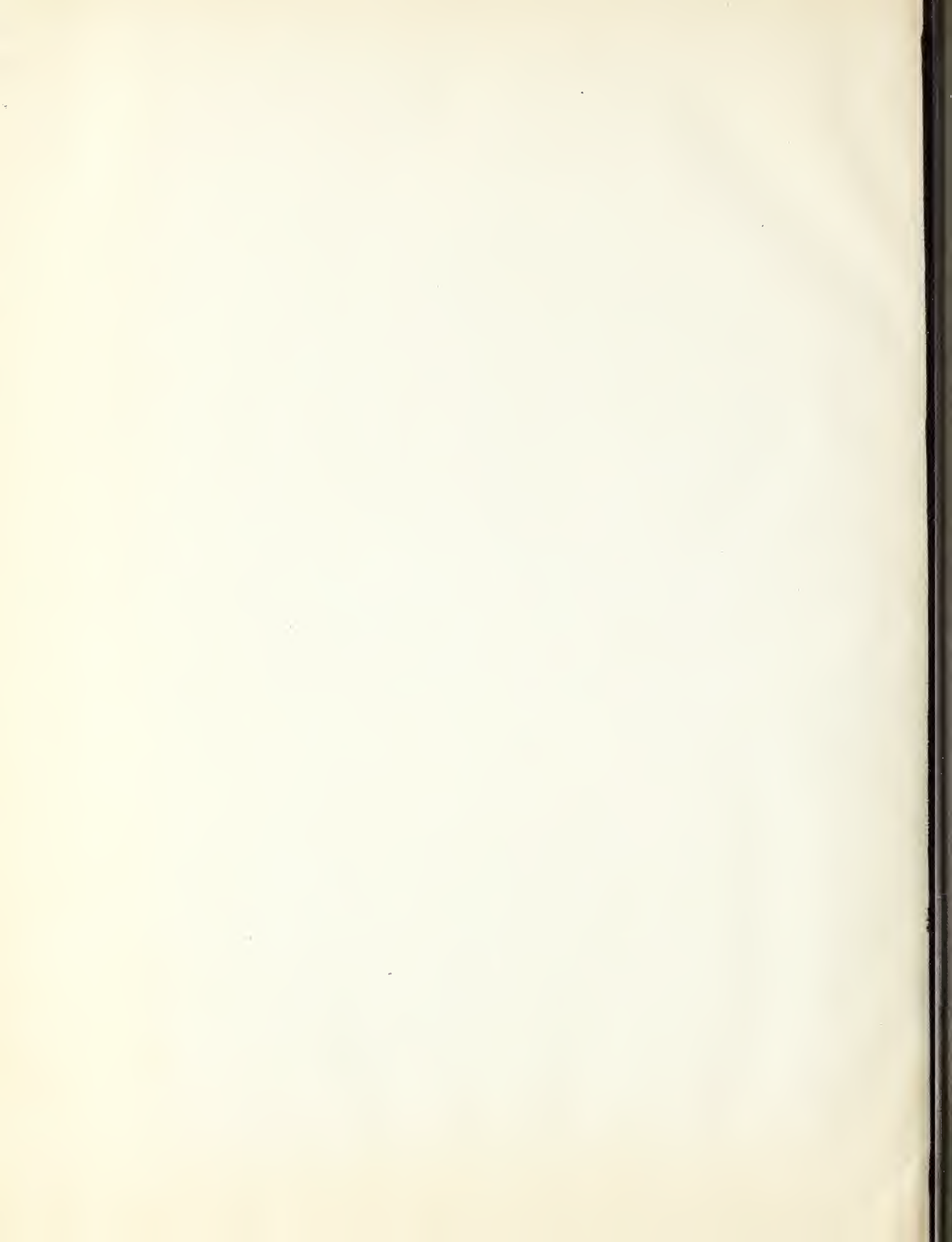
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